THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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RAILWAY ELECTRIFICATION.

IN our last three issues we have reproduced illustrations of the fine new power station of the London and South-Western Railway Co. at Wimbledon Park, which is approaching completion; very shortly the company will be in a position to commence electrical operation on some of its suburban lines—an event which will bring joy to the hearts of the long-suffering residents in the districts concerned, for, while we congratulate the directors on the receptive frame of mind which has enabled them to accept the new order of things as inevitable, we are impelled to remind them that the "leisurely jog-trot" methods that have prevailed on their system up to the present are years behind the times. The phrase we quote was used by a railway contemporary in this connection, and aptly describes the situation.

But let us not be ungenerous: the London and South-Western Railway Co., having recognised the necessity of adopting electric traction, has tackled the problem in no half-hearted fashion, and the scheme which it is now carrying out, embracing a system of 150 miles of track, must be regarded as one of the most important undertakings of the kind in this country, being, in fact, second only to that of the Brighton Co. in point of length of track to be electrified, and serving an area which, in many ways, is second to none.

The methods adopted for the electrification of the railway present many features of interest and not a few of novelty; in view of the wide experience that has already been acquired on English railway systems, as well as abroad, and has, no doubt, been fully utilised by the company's engineers, we take it that these methods are regarded by them as the best at present known for the class of traffic to be dealt with. Prominent amongst them are: The adoption of the third rail and direct current; the organisation of the rolling stock into set trains of three coaches each (two motor coaches with a trailer between); mounting the contactors inside the coaches instead of beneath them; and automatic acceleration. We might add the conversion of the existing rolling stock, but this is a matter which depends largely upon circumstances, and the same may be said regarding the policy of erecting a power station instead of purchasing energy from existing sources.

That the problem of electrification is still far from finding a broad solution is demonstrated by the fact that two of the most important electric railway systems in the country have been developed on divergent lines; the Brighton Co. adopted single-phase supply and overhead conductors, while the South-Western Co. has employed the third rail and direct current; the former buys energy, the latter produces it; and other differences might be named—yet both companies contemplate large extensions of their electrified systems, which must eventually result in "main-line electrification." It is certainly very regrettable that uniformity of system cannot be attained at present, though its value may perhaps be overestimated except in cases where interchange of passenger rolling-stock is concerned. The same conditions are met with in other countries that have carried out large projects of electrification, and clearly the battle of the systems is going to be prolonged indefinitely.

The growing importance of railway electrification in this country may be realised when we state that the aggregate length of single track now under, or being equipped for, electrical operation is nearly 1,000 miles.

Rubber.

The tendency of prices in the market for crude rubber has not disclosed any serious alteration during the past few weeks, and rates have, on the whole, been held together very well, and this in spite of the fact that good quantities have been reaching this side, although some delays have been experienced in discharging cargoes. The outlook is regarded as moderately satisfactory, and there has been a certain amount of forward buying done, mainly in connection with plantation grades. There seems no reason to anticipate any serious setback in prices, and there is no doubt about the excellence of consumption, and this is likely to continue for an indefinite period, war requirements being on an unprecedented scale. There has been some discussion regarding rubber supplies really intended for Germany being shipped to Scandinavia, and it is suggested that while the United Kingdom has been supplying increased quantities of rubber to the United States at the expense of other neutrals, American exporters have taken advantage of this to enlarge their consignments of rubber to Holland, Norway and Sweden. The re-exports of rubber from the United Kingdom to the countries named declined, from 17,727 centals of 100 lb. in January-May, 1914, to 16,693 centals in January-May, 1915, while the exports of rubber from the United States to the same destinations increased during that period from 1,579 centals to 5,040 centals.

It is understood that Germany is exceedingly short of rubber, and a reward of £5,000 has been offered by the German Government for the discovery of a satisfactory process of regenerating rubber. What is desired is something far in advance of any known process of reclaiming, and it is specified that by the regenerating process the resiliency of the original rubber must be recovered to an extent of at least 90 per cent. in order to make the process eligible for competition. There is not the least doubt that the problem of supplying the German Army with a sufficient quantity of tires is beginning to assume a grave aspect, and it is reported that negotiations have been opened up with the manufacturers of a fibre tire which it is hoped will prove a solution of the difficulties now being faced.

An official cablegram received from Singapore announces that the export of plantation rubber from the Straits Settlements during the month of August amounted to 2,295 tons, compared with 2,324 tons in July and 1,325 tons in the corresponding month last year. The following is a comparative table showing the totals for three years :—

	1913.	1914.	1915.
	Tons.	Tons.	Tons.
January	784	1,181	2,576
February	743	1,703	2,741
March	898	1,285	2,477
April	762	1,548	1,978
May	814	1,309	3,588
June	812	1,480	2,249
July	1,120	1,584	2,324
August...	1,315	1,325	2,295
Total	7,248	11,415	20,228

These figures include transhipments of rubber from various places in the neighbourhood of the Straits Settlements, such as Borneo, Java, Sumatra and the non-Federated Malay States, as well as rubber actually exported from the Colony, but do not include rubber exports from the Federated Malay States.

The Spanish Electrical Industry.

The industrial position in Spain is becoming very unfavourable owing to the scarcity of raw materials which are necessary to keep the manufacturing works in operation. It was stated two or three months ago that a large amount of electrical work was being held up in consequence of the war and the inability to obtain primary materials, there being no possible means in the country for securing these in a considerable quantity. As is known, Spain possesses important mining centres where iron ore, copper and other metals are produced in abundance, and the transportation of these raw materials to other countries provides occupation for a fleet of steamers which are almost exclusively engaged in this particular work. Senor E. Rubio, who draws attention to the subject in the *Energia Electrica*, states that the coal resources of the country are adequate for greatly developing the native industries. In this respect, however, the worthy Spaniard is not in harmony with other authorities, who submit that if the necessary colliery plant were available it might be possible to increase the present production of 4,150,000 tons of coal per annum by 25 per cent., but the machinery is lacking for the near future. Nevertheless, even a 25 per cent. augmentation of about 1,000,000 tons would not dispense with the necessity for importing coal as, under normal conditions, Spain imports about 2,500,000 tons of coal and coke yearly, chiefly from Great Britain. Senor Rubio, however, contends that the mineral riches of the country should form the basis of all kinds of metallurgical works which would be able to supply the whole of the requirements of the home market. To some extent the industries already exist.

Coming to consider the electrical industry in particular, the Spanish author recalls the existence in the country of important electrical engineering works, cable factories, lamp factories, &c. Although these branches do not enjoy the particular Government protection that is deemed to be necessary, everything was proceeding admirably down to the time of the outbreak of the war. The works construct generators, motors, transformers, &c, but they do not possess an adequate quantity of iron or steel sheets. The iron ores are exported, but the belligerent nations neither return them in a manufactured form nor permit the Spaniards to supply themselves through other neutral countries on the ground of their being contraband. In the case of the cable factories work was proceeding at full capacity, and makers were thinking of embarking on the export trade, but there is no national production of copper wire. The copper ore is exported, but there is no re-exportation in wire, sheets, &c., under existing conditions; and the same observations apply successively to the other engineering industries under the present state of war. Senor Rubio, however, overlooks the fact that a considerable amount of British capital is invested in Spanish iron ore and copper mines, and that even if it were regarded as commercially possible to erect smelting plant and transforming mills in that country, the Spanish market would be unable to absorb most of the output, whilst the difficulties in regard to the supply of native labour of the right kind would probably be insurmountable. At the same time, it is possible to appreciate the paradoxical statement that the identical country which is rich in raw materials has to beg of the belligerents for the re-exportation of the former in a semi-manufactured condition in the shape of sheets, wire, &c.

It is considered that the national needs of Spain require a solution of the problem, as many interests are being prejudiced by the suspension of electrical work, which could be carried out if the primary materials were available. One solution, according to Senor Rubio, is immediately at hand. It is that the Government should protect the electrical industry by making diplomatic representations, so as to secure the removal of the contraband veto on the export of the raw materials wanted by Spain, the Government giving, if necessary, a guarantee that they would be consumed in the country and prohibiting re-exportation. In addition it is suggested that the materials should for the time being be admitted free of duty or at reduced duties, and that the shipping companies should also lower their rates for freight. The permanent solution of the problem, in the opinion of the Spanish author, lies in the placing of the industries of the country in a state of true economic independence by discontinuing the "suicidal exports" of raw materials which, it is held, should be worked up in Spain, instead of its being necessary in normal times to procure semi-manufactures from the other nations which receive the Spanish iron, copper and other ores. Senor Rubio is under the impression that if the war had not occurred foreign capitalists would have been prepared to transform Spanish ores, particularly copper, into partly manufactured products in Spain, but he gives no authority for this assumption.

NEW ELECTRIC STEEL FURNACES.

In our issue of July 25th, 1913, we gave particulars of some electric steel furnaces in Sheffield, with special reference to one installed by Messrs. Electro-Metals, Ltd., which at that time was the only one of its kind in this country. Since that date great progress has been made, and the company has a large number of furnaces at work, in which many improvements have been made.

The Electro-Metals furnace is an arc furnace using two-phase current. It has two upper electrodes, and one lower or hearth electrode; the upper electrodes carry separate phases, and the lower electrode forms the common return of what is really a two-phase three-wire system. This is illustrated in fig. 1, which shows diagrammatically the essential features of the system. Two single-phase transformers (Scott connected) are shown, fed on the high-tension side

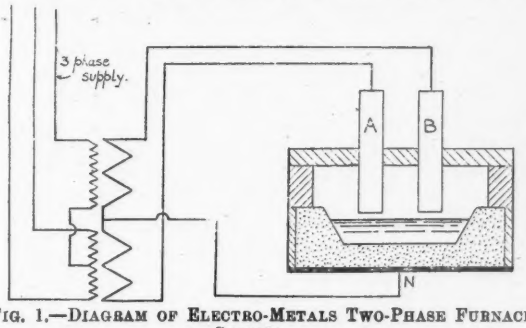


Fig. 1.—Diagram of Electro-Metals Two-Phase Furnace System.

with three-phase current and delivering low-tension two-phase current to the furnace. Thus current flows through the upper electrodes (A and B) across the arc gaps where the intense heat is generated, then through the metal charge and the basic lining to the lower electrode (N), and so returns to the transformers.

The furnace is equally suitable for melting common steel

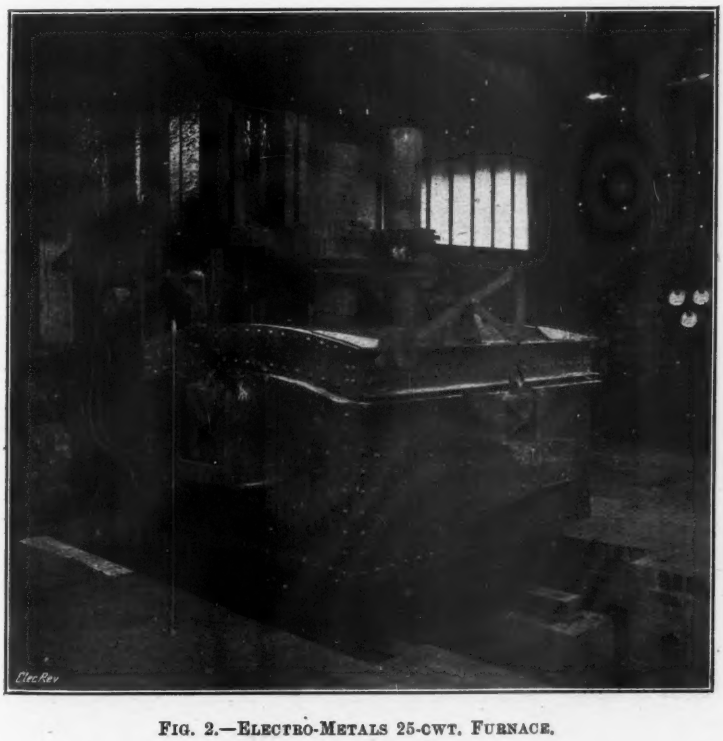


Fig. 2.—Electro-Metals 25-cwt. Furnace.

or wrought iron scrap and refining to high quality steel, or for refining fluid metal from Bessemer vessels or open-hearth furnaces. It is admirably adapted for the production of tool or alloy steels and all grades of steel castings.

Continuous current is not suitable for electric steel furnace work, alternating current being always used. Practically all power supplies are either two or three-phase, and it is, therefore, one of the great advantages of the Electro-Metals two-phase system that such supplies can be utilised directly by means of static transformers, without the intervention of costly and inefficient motor-generator sets, such as are required for furnaces using single-phase current.

Where the primary supply is two-phase, power is delivered from the mains through two single transformers, one on each phase, to the furnace at suitable voltage. In the case of a three-phase primary supply, the two transformers are arranged with the well-known Scott connection to deliver two-phase low-tension current to the furnace.

The furnaces normally use current at a pressure of about 80 volts on each phase, but the larger sizes are

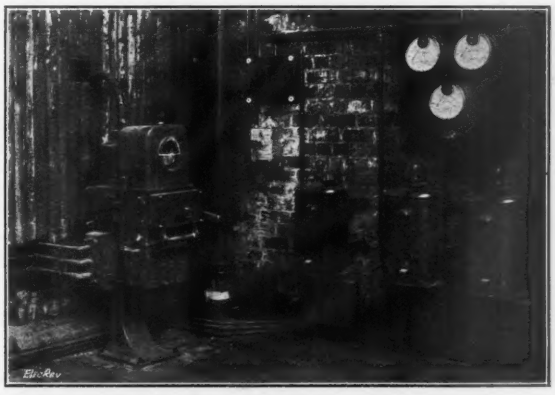


Fig. 3.—Electrical Control Gear for 25-cwt. Furnace.

arranged for a choice of two voltages, the higher one being used during the melting period and the lower one during the subsequent refining (see fig. 4). On the low-tension side of the transformers each phase is connected to one of the upper electrodes. In this way the arcs between these electrodes and the charge are formed independently of one another, an arrangement which ensures very steady running during the melting period. In all furnaces where the arc plays between the electrode and the metal, the sudden melting of pieces of metal directly under the electrodes causes certain fluctuations of the load, and it often happens that the arcs become temporarily broken in this way. With a single-phase furnace having arcs in series this means that when one arc is broken the whole load is instantly thrown off the mains, but with the Electro-Metals two-phase system, which has the arcs in parallel, the breaking of an arc only results in half the load being momentarily thrown off the system. Thus, violent fluctuations are avoided; the heating is continuous, the melting is accelerated, and, consequently, the energy consumption is reduced.

The electromagnetic effect due to the two-phase arrangement produces a thorough circulation in the bath of molten metal, which facilitates the chemical reactions of refining by bringing all portions of the charge in rapid succession into intimate contact with the slag. This steady circulation results in the rapid melting of the alloy additions which are made in the manufacture of special steels, a condition difficult to obtain with furnaces having purely surface heating.

The circulation has the further very important effect of equally distributing the intense heat from the arc throughout the entire charge, thus protecting the roof and lining of the furnace from local overheating.

The lower or neutral electrode consists of a layer of carbon mixture evenly rammed over the bottom of the furnace tank,

and the basic lining is rammed in above this carbon layer. This lining is made of either dolomite or magnetite mixed with tar and thoroughly burnt in, and is, when hot, a good conductor of electricity, offering only a small resistance to the passage of the current. For example, if the pressure on each phase is 75 volts, there will only be a drop of about 3 volts between the metal in the bath and the neutral terminal. The heat developed by this comparatively small resistance serves, however, to keep hot the lower portion of the furnace hearth, thus preventing the solidification of any unrefined metal on the bottom of the bath and ensuring homogeneity of the charge.

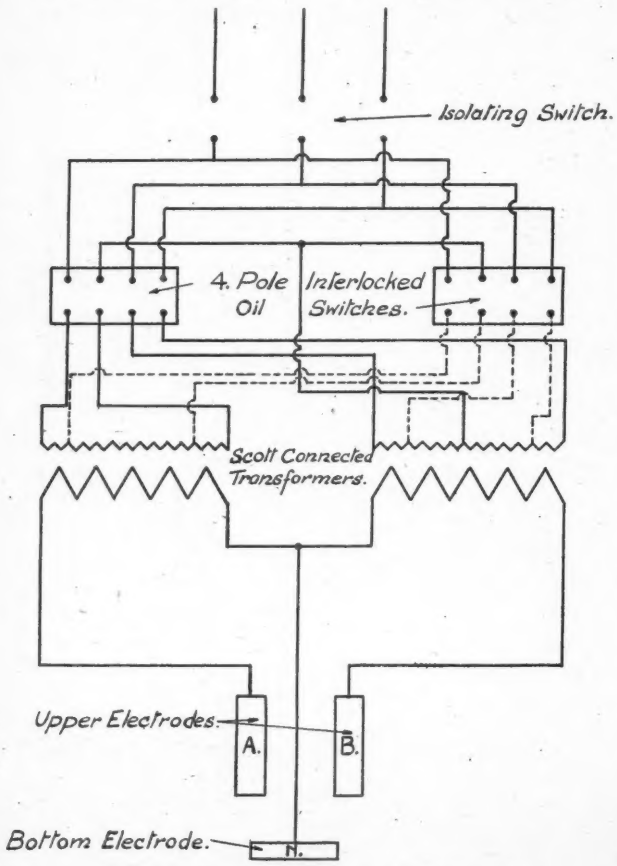


Fig. 4.—Diagram of Electrical Connections.

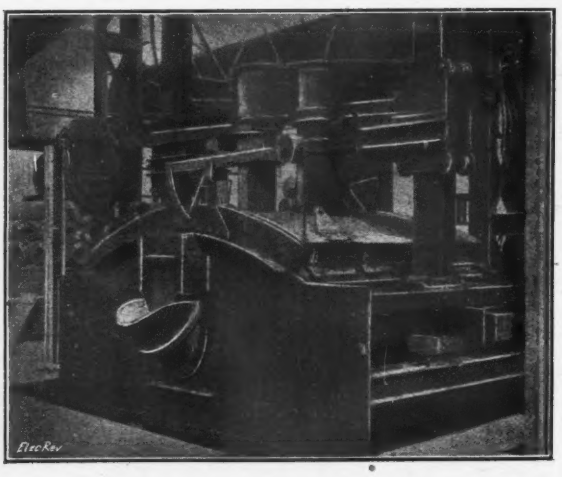


Fig. 5.—Electro-Metals 4-ton Furnace.

The general construction of the furnace varies according to the amount and kind of work which it has to do. In the smaller sizes, the raising and lowering of the electrodes and also the tilting of the furnace may be done by hand-operated gearing. In the larger sizes electrically-driven tilting gear is necessary, and the electrodes, owing to their weight, must be operated by motor-driven gearing, which may be hand-regulated or automatically controlled. Furnaces over 6 tons capacity are arranged for four electrodes, two on each phase, all four being separately controllable.

The body of the furnace itself is of steel plate construction suitably strengthened to avoid bulging when hot. The electrodes are held in specially-designed holders with suitable electrical contacts. Each holder is connected to, and insulated from, a carriage which runs over and between two vertical channels. The carriage is raised and lowered by a vertical screw placed centrally between the channels, the screw being actuated by a worm and worm-wheel or by bevel gearing coupled to a small motor. The furnace roof, which consists of a steel frame holding an arch of silica bricks, is detachable from the shell, and is always provided in duplicate so as to facilitate the replacing of an old roof by a new one. The electrode gear is best placed at the back of the furnace, that is, opposite to the teeming spout, as this arrangement allows for two working doors, one at either end of the furnace. This arrangement is shown in fig. 2. The tilting gear (see fig. 7) is placed below and behind the furnace, and is driven by a suitable motor. The latter, by means of reduction gearing, drives a large bevel wheel mounted on trunnions, in the centre of which is a screwed bronze sleeve. Through this sleeve passes the long screw which is fastened at the upper end to a bracket at the back of the furnace. Turning the bevel wheel either pushes up this screw, and so tilts the furnace forward, or else, when the motor is reversed, the screw is drawn down and the furnace tilted backward. The tilting screw is of such length as to give a forward tilt of 40° and a backward tilt of 5°.

The electrical equipment varies according to the voltage and periodicity of the high-tension supply: according to whether the electrode motors are to be controlled by hand or by automatic regulators: and also according to the working voltages. Sometimes two low-pressure voltages are desired, a higher one for melting and a lower one for refining, in which case two interlocked switches are necessary, so as to be able to change over from one voltage to the other without delay (fig. 4).

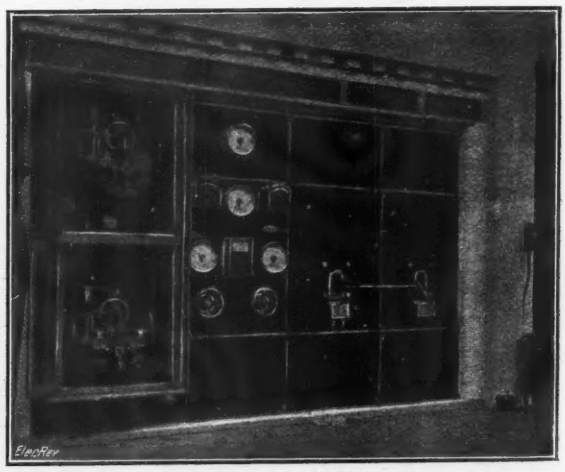


Fig. 6.—Switchboard for 4-ton Furnace.

When the electrode motors are controlled by hand, tramway type reversing controllers are installed, operated in accordance with the readings of the ammeter on each phase. Automatic control of the electric motors can be carried out by means of Thury automatic regulators, one for each motor, which are operated by series transformers, mounted on the low-tension leads. A rheostat in the secondary circuit enables the regulator to operate at any desired amperage on the furnace. Reversing controllers are also provided which cut out the automatic regulators and enable the electrodes to be quickly hoisted out of or lowered down into the furnace (see figs. 3 and 6).

The instruments for the control of the furnace are mounted on enamelled slate panels, and consist of an ammeter for each of the upper electrodes and one on the

neutral return, all of which are operated from series transformers mounted on the low-tension cables. A voltmeter is provided which has a three-way switch to indicate the voltage on either phase, and also the pressure across the two phases. If desired, integrating, indicating or recording kilowatt meters can be arranged for on the instrument panels.

The following is a description of the working of a typical charge, when melting and refining common scrap to high quality steel.

After the furnace has been fettled from the previous charge, the cold scrap is thrown into the hearth. The scrap is preferably of steel or wrought iron, and is usually of common quality containing up to 0·10 per cent. each of sulphur and phosphorus. When charging is completed the current is switched on and the electrodes are lowered until the arc is struck between them and the upper portion of the charge. The current is then kept constant at the desired amount, either by means of the hand controllers or the automatic regulators.

The heat from the arc soon melts a large hole in the charge underneath and around each electrode, which continues to travel down as these holes become deeper, until a bath of fluid metal is formed in the bottom of the furnace. This bath gradually increases in size and depth owing to other portions of the charge melting into it, and consequently the electrodes commence to rise with the level of the metal.

By the time they have risen to the usual working level of the bath, any unmelted portions of the charge are detached from the sides and pushed within the hot metal in the centre. During the melting the slag is added, consisting of a mixture of lime, fluorspar, sand, and either iron ore or hammer scale. This slag, owing to its lower density, floats on the top of the molten metal, and the chemical actions of refining take place. The carbon in the scrap is oxidised by the iron oxide in the slag, and is given off in the form of carbon-monoxide, which, rising through the metal, gives the appearance of boiling. This boiling serves to bring the slag and metal into more intimate contact. The silicon and manganese in the scrap are oxidised, and their respective oxides dissolve in the slag. The phosphorus is oxidised, and, in the presence of the lime in the oxidising slag, is formed into a phosphate of lime, which enters into the slag. A portion of the sulphur is also oxidised, and passes away as gaseous oxide.

When sufficient time for these reactions to take place has elapsed, the current is switched off, and the furnace tilted forward. The bulk of the slag is run off through the tapping spout, and the remainder is pulled off the surface of the metal by means of rabbles, so that in this way the phosphorus is removed from the steel. Recarburising additions are made to give the required carbon to the steel, and another purifying slag is thrown in. This second slag consists of lime, sand and fluorspar, and quickly melts when the current is again switched on. The power used in the furnace during the subsequent refining is only about one-half of that required during the melting period. The phosphorus, as stated above, has been removed, but there remains among the injurious constituents in the metal the bulk of the sulphur, and in addition a certain amount of oxide of iron which has come from the oxidation of the scrap during the melting and from the oxidising slag that is necessary for the removal of the phosphorus. The metal must therefore be freed from this oxide and from the sulphur. The oxide of iron in the metal is also soluble in this new slag, which takes it up until the solvent powers of the two fluids are equal. The oxide is then removed from the slag by means of the addition of finely-divided carbon in the form of powdered anthracite, which reduces the oxide of iron in the slag and at the same time makes a reducing atmosphere of carbon monoxide inside the furnace. Under these circumstances the oxide of iron in the steel is continually passing into the slag as the carbon reduces it, and in this way the whole of the metal is gradually freed from its oxide. At the same time, under the reducing conditions and under the influence of the chemical composition of the slag, the whole of the sulphur is automatically removed from the metal into the slag.

The steel being now purified is ready for "teeming" into the ladle, its composition being adjusted to that required, by the addition of alloys, the quantity of which is based on the result of a test analysis taken from the bath during the refining. A small addition of aluminium or an alloy of aluminium is usually added at the end in order to remove any trace of gases which may remain in the steel.

The ladle is then brought under the tapping spout of the furnace, the small door above this is opened, and the furnace is tilted right over and its contents emptied into the ladle, from which it is teemed into the moulds.

Working Costs for Electro-Metals Furnaces.

(A) *Melting and Refining Common Steel Scrap to High Grade Metal suitable for Steel Castings.*

Size of furnace	25 cwt.	2½ tons.	5 tons.
No. of casts per week (double shifts)	25	20	18
No. of tons per week... ...	31·25	50	90
No. of tons per year (45 working weeks)	1,406	2,250	4,050
Transformer capacity, KW. ...	300	500	900
Energy consumption per ton, KW.-hours	850	800	750
Electrode consumption, lb. per ton	45	40	35

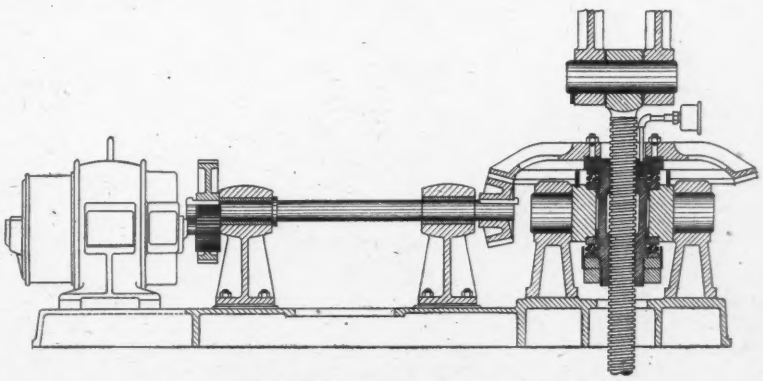


Fig. 7.—Motor-driven Tilting Gear: Section.

Costs per Ton of Metal in the Ladle.

	£ s. d.	£ s. d.	£ s. d.
1. Scrap at 55s. per ton (allowing 7 per cent. loss)	2 19 3	2 19 3	2 19 3
2. Energy at 0·5d. per unit	1 15 5	1 13 4	1 11 3
3. Electrodes at 1¾ l. per lb.	6 7	5 10	5 1
4. Labour	6 6	5 8	4 11
5. Materials for slags ...	1 9	1 6	1 2
6. Alloys adding 0·25 per cent. Si and 0·75 per cent. Mn.	4 6	4 6	4 6
7. Repairs and maintenance	8 7	5 10	4 6
8. Ladle costs	2 11	1 9	1 5
Total... ...	£6 5 6	£5 17 8	£5 11 3

Management, laboratory and overhead charges are not included.

(B) *Melting and Refining Common Steel Scrap and Producing High-Quality Tool Steel.*

Size of furnace...	25 cwt.	2½ tons.	5 tons.
No. of casts per week (double shifts)	22	18	16
No. of tons per week	27·5	45	80
No. of tons per year (45 weeks ...	1,237	2,025	3,600
Energy consumption per ton, KW.-H.	900	850	800
Electrode consumption, lb. per ton ...	50	45	40
Costs per ton ingots.	£ s. d.	£ s. d.	£ s. d.
1. Scrap at 55s. (7 per cent. loss)	2 19 3	2 19 3	2 19 3
2. Energy at 0·5d. per unit	1 17 6	1 15 5	1 13 4
3. Electrodes at 1¾d. per lb.	7 4	6 7	5 10
4. Labour	7 3	6 3	4 7
5. Materials for slags ...	1 9	1 6	1 2
6. Repairs and maintenance	8 10	6 0	4 7
7. Ladle and moulds ...	7 4	5 10	5 1
Total... ...	£6 9 3	£6 0 10	£5 13 10

Management, laboratory, overhead charges, and alloys are not included in the above costs.

The following Electro-Metals furnaces for steel making have been installed, or are in course of construction, at the present time :—

Messrs. Darwin & Milner, Sheffield	2½	tons.
Messrs. Soderfors Bruks A.B., Sweden	2½	,,
Messrs. Kayser, Ellison & Co., Ltd., Sheffield ...	4	,,
,, ,, ,, ...	8	,,
Messrs. Swift, Levick & Sons, Sheffield	4	,,
Messrs. Jno. A. Crowley Co., Detroit	5	,,
Messrs. T. Hackett & Sons, West Bromwich	25	cwt.
Messrs. Robert Hyde & Son, Ltd., Sheffield	25	,,
Messrs. Kryn & Lahy Metal Works, Ltd., Letchworth	30	,,
The National Steam Car Co., Ltd., Chelmsford ...	2	tons.
Messrs. Altos Homos de Vizcaya, Bilbao	2½	,,

The Electro-Metals system is also being used for the manufacture of ferro-alloys.

ELECTRICITY IN SUBMARINE MINING.

In several of our French contemporaries recently the application of electricity to the operation of submarine mines has been described, on the basis of a detailed article by M. Antoulaïeff, professor at the Ecole Militaire Electrotechnique, of Petrograd, which was originally published in *Electritchestvo*.

Free mines, which are not connected with the shore, and are dangerous to all vessels, because they explode at the first contact, are fitted with batteries inside them; stationary mines are connected by submarine cables with stations on the shore, where the batteries are situated. Automatic mines contain an apparatus which closes the circuit when a vessel bumps the mine, sending a signal to the shore, whence, automatically or otherwise, a strong current is transmitted to explode the mine. Observation mines, on the other hand, are moored at known spots which are kept under observation with telescopes, and when a hostile ship passes over a mine, the latter is sprung by the observer. In this case extreme accuracy is essential, if the mines are far from the shore.

The batteries used are in some cases required to maintain a weak current continuously; but, generally, the batteries are intended to give a strong current for a short time. In the case of the batteries in free mines, the exciting liquid is introduced into the cells only at the moment when they are required to operate. Sometimes one needs a cell of low E.M.F. and high internal resistance, to ensure

Fig. 1.—Connections for Automatic Firing of Submarine Mines.

that the current shall never exceed a few milliamperes; for this purpose a piece of submarine cable in sea water has been found suitable, the electrodes being the copper conductor and the galvanised-iron sheathing wires. The E.M.F. is from 0·01 to 1 volt, and the resistance hundreds of ohms.

The submarine cable used consists of a stranded copper conductor insulated with gutta-percha, several layers of rubber, and several layers of impregnated tape, the whole being sheathed with galvanised-iron. The resistance of the cable is 5 to 12 ohms per km., and the weight up to 500 kg.

The detonators are usually actuated by the heating property of the current. Experience shows that the fuse wire should not exceed 0·025 mm. in diameter, an alloy of platinum being used; the length of the wire and the density of the explosive are important factors in relation to the sensibility of the detonator.

The apparatus at a shore station has to provide for the testing of the circuits and batteries, the reception of a signal when a vessel touches a mine, and the transmission of the firing current, so that an elaborate control board is required.

When the operation of the mines is effected automatically, the warning signal simultaneously actuates a relay permitting the firing current to pass to the line. When it is desired to render the mine inoperative, the switch controlling the firing battery is opened.

The connections of the automatic mine are shown in fig. 1, in which A and B are terminals connected respectively to the core and the sheathing of the cable, C is an indicator, D a plug board, E and F two pairs of terminals, H an ordinary galvanoscope, of which the pointer when deflected to a certain extent makes contact between two

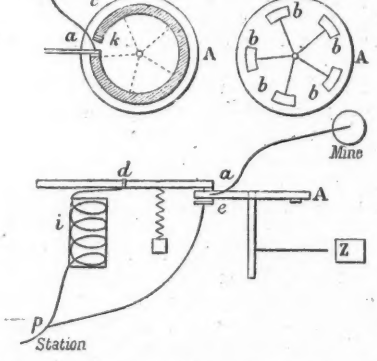


Fig. 2.—Apparatus for Recording the Number of the Mine Exploded.

springs, and K is an electromagnetic relay with poles at *a* and *b*, and an armature which rotates about a fixed axis at *f*. When the armature of this relay is in the position shown by the firm lines, the lever *c* is held against the pull of a spring *d* by a tooth attached to the armature. N registers the number of times the circuit of the battery O is closed.

When a vessel strikes a mine, a connection is produced between the conductor and the sheathing of the cable, and the current from the local battery G increases, so that the pointer of the galvanoscope H is strongly deflected and closes the spring contacts, thus energising the relay K by means of the battery J. The armature of the relay releases the lever *c*, which makes contact with *e*, and at the same time interrupts the circuit through the galvanoscope, so that the pointer of the latter returns to its normal position and the circuit of the relay is opened. The armature of the relay, under the action of a spring, closes the contacts *g* and rings the bell L.

If the double-pole switch M is closed when the lever *c* makes contact with *e*, the firing current at once passes to the line by way of the plug-board D and explodes the mine. If the switch M is left open, the ringing of the bell announces that the mine has been struck by a ship, and it can be fired, if desired, by closing the switch, or reset by replacing the lever *c*.

The mines are usually connected in parallel, and each mine has to be provided with an indicator to show which mine has exploded. This device is illustrated diagrammatically in fig. 2. A disk A turns in the clockwise direction under the action of a spring, and carries on its upper side an ebonite ring *c*, to which is applied a metal tongue *a*; on the lower side are several metal contacts *b*, their number corresponding to that of the mine, less one. These contacts are connected together, and by way of the pivot with the sheathing of the cable. When the mine closes the circuit, the firing current passes from the controlling station by

the shunt *p*, through the winding of the electromagnet *i*, into the axis of the armature *d*, and so to the tongue *a* and to the mine. The armature is attracted and releases the disk, which begins to rotate, while the tongue *a* rests upon the ebonite ring and the circuit *p*, *i*, *d*, *a* is thus interrupted; during this rotation the contacts *b* touch the spring *e* in succession, so that the firing current passes (in the case illustrated) five times into the cable by way of *p*, *e*, *b*. Consequently when mine No. 6, to which this apparatus is connected, explodes, the firing current passes six times in all before the circuit is left open, and permits the recorder N to register the number of this mine. The disk A is brought to rest by the stop *k* meeting the tongue *a*, leaving the circuit open.

A detonator much used in Russia is that invented by an engineer officer named Dreyère, and consists of a piece of ebonite *a*, fig. 3, into which are inserted two screws *b* and *c*, with sharp points, separated by a gap of one or two millimetres. Into the space between the points an explosive is introduced, to which graphite is added to increase the conductivity. The apparatus is put in circuit by means of the insulated wires *gd* and *e*, which are connected to the screws. If a source of electrical energy of at least 45 volts A.C., or 65 volts D.C. is applied to the circuit, sparks are produced between the particles of graphite in the priming, and the latter is ignited, bursting the ebonite at the thin upper part so that the flames pass through into the charge. A capsule *h*, filled with fulminate of mercury, is usually attached to the upper end of the detonator and is deflagrated by the ignition of the explosive.

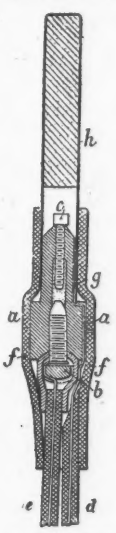


FIG. 3.—SECTION OF DREYERE DETONATOR.

Detonators can be prepared of any desired resistance by varying the composition of the explosive. Usually the resistance is from 10,000 to 20,000 ohms, according to the characteristics of the source of electricity employed, which, in the case of land mines, may be a magneto exploder. Such a machine consists of an armature driven through gearing by a handle, and three steel magnets; the armature is wound with 2,500 turns of insulated wire, of 500 ohms resistance, and makes six revolutions per turn of the handle, which should be turned at least four times per second. The total weight of the machine in a wooden case is 5 kg., and it gives a pressure of 70 volts when the external resistance is 1,000 ohms, 45 volts for 500 ohms, and 35 volts for 250 ohms. Thus it could be used to explode simultaneously 20 detonators of 10,000 ohms resistance.

Another type of exploder is an ordinary D.C. dynamo with series excitation; it is provided with a condenser, and an arrangement which allows the current to pass into the external circuit only once while the crank makes two revolutions (and armature 12 revolutions). A moment before the external circuit is closed, the circuit containing the condenser is opened, and besides the discharge of the condenser, the "extra-current" of opening is thrown into the external circuit. In this machine the armature resistance is 1,100 to 1,300 ohms, that of the field magnets 1,600 ohms, the capacity of the condenser 0·008 to 0·024 mfd., and the voltage 170 volts; the apparatus weighs 27 kg., and can explode 30 detonators in parallel simultaneously. Detonators are always connected in parallel, because they cannot be made precisely alike; if they were in series, the most sensitive would go off first and open the circuit, leaving the other detonators intact.

The Zeppelin and the Lamp.—The unexpected does not always happen. When London was visited by the craft of the Kultured Count recently, and dropped bombs in a certain district, everything around was shattered except one electric lamp which remained, we are informed, "in solitary glory," and that lamp was a "Mazda." We shall hide behind a bank of them next time.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The A.E.G. Meeting.

We think the suggestion made by "No Furtiveness" that firms shall state whether they are or are not supplying the Electrical Company or A.E.G. with machinery, &c., is a good one, and it gives us great pleasure to state that during the past 15 months we have not, directly or indirectly, supplied to the Electrical Company, A.E.G., or any of its agents, any machinery or goods of any kind. We have been approached by them on several occasions, but most of their letters have been ignored, and we have been struck by the attitude of their travellers, all of whom are British, who have visited us endeavouring to sell goods, and openly boasted that they could supply us with anything that their parent company made, and that it was their intention to keep the Charing Cross Road establishment going, so that they would be ready to go straight on with an increased turnover as soon as the war was over. We know the firms, in particular one not far from the centre of England, which is supplying the Electrical Company with motors, and we are sorry that the B.E.A.M.A. has not so far seen its way to answer some of the correspondence, and so clear its members.

E. Brook, Ltd.

Huddersfield, *October 2nd*, 1915.

I am glad to see that my protest in your issue of September 17th has aroused some interest, and I trust that you will allow me some further space in order to drive home my points. Let it be remembered that here is a company, registered in London under a British name, which is merely an offshoot of the A.E.G. of Germany, and which, although not allowed to import goods from, or to export money to, Germany, is, nevertheless, being "nursed" in order that, when the war is over, the A.E.G. may come into its own again. The late head of the A.E.G., Dr. Rathenau, was one of the Kaiser's familiar spirits, like Herr Ballin, and undoubtedly shared the responsibility of forcing on this world-war for German dominion. The present head, Dr. Walther Rathenau, recently made a violent anti-English speech, and his company has been engaged for many months in turning out instruments of destruction against us and our Allies. The Electrical Company is, therefore, merely a nest which is being kept in order, against the time when the gentle German Eagle will lay eggs in it, in the form of dumped German electrical goods, to the detriment of our own manufacturers. Those Englishmen who are at present carrying on this business are, however, no less unpatriotic than those who are helping to keep it alive by trading with it. The former have no excuse that it is their bread and butter; any competent man can find a job nowadays. The latter have not even this excuse. It is difficult to discover all their names, but anyone looking into the window in Charing Cross Road can see examples for himself. . . . . Perhaps the manufacturers of these goods will explain.

Inquisition.

October 5th, 1915.

Receipt Forms on Cheques.

A printed receipt form on all cheques would be particularly useful at a time like the present, when office staffs are depleted through enlistments and increased postage charges are proposed.

Preferably the receipt should be printed on the back of the cheque, for then one signature serves as an endorsement and a receipt. The wording could be:—

"Received from
(Name of firm.)
.....
The amount named on the face hereof.
The signature of payee
.....
Stamp for £2 or over.
Date.....191
This receipt is also the endorsement of the cheque and is the only acknowledgment required."

The paid cheques can be pasted on to the counterfoils in the cheque book, and the receipts are thus kept in handy form for audit purposes.

Accountant.

A Transformer Query.

I shall be obliged if one of your readers can offer a solution to the following problem:—Three 3,810-230-volt transformers were connected to a 6,600-volt three-phase alternator (earthed neutral); the transformers were connected in star on the primary and secondary sides and the latter earthed; the voltage between phases on secondary was 400, which, of course, was quite correct, but the voltage across any one phase was 260 (30 volts high).

When the neutral point on primary was connected to earth, the secondary voltage became normal. Is it possible that this was due to a third-harmonic voltage, or was it due to the capacity of the transmission line and transformers?

M. M.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Multiple-Break Tumbler Switch.

We recently described a single-tumbler double-pole switch which Messrs. A. P. Lundberg & Sons, of 477-489, Liverpool Road, London, N., have put on the market; a switch of similar construction has now been introduced by the firm, under the title of the "Quadbreak" switch, it being a single-way switch with four breaks in its circuit.

The switch is designed for pressures up to 250 volts, and is intended for use in circuits where there is a liability to heavy spark wear through high voltage or current, or both, or owing to the inductance of the apparatus controlled.

Surface types are made for 5 and 10 amperes, and a flush pattern for 5 amperes; if the current be reduced, the switch may be used on circuits at proportionately higher voltages—up to 400 volts In view of the tendency nowadays to put heavier work on tumbler switches, this device should prove very useful. It will deal with currents 50 per cent. above its rated capacity, if the circuit is not very inductive.

Ferranti Bar Fires.

In connection with their electric fires, Messrs. Ferranti, Ltd., of Central House, Kingsway, W.C., have recently issued a new folder, H 75/4, covering the latest patterns.

One of these "bar" fires, type F B D a, is illustrated in fig. 1, and contains two heating elements each of 750 or 1000 watts maximum loading. Each element, fig. 2, is controlled by a separate switch, so that either or any of them can be used as desired; the elements consist of a heating spiral clamped between specially shaped bars of porcelain, which are threaded on to screwed rods fitted with nuts at either end. The ends of the heating wire are clamped under these nuts, the rods or bolts becoming the terminals.

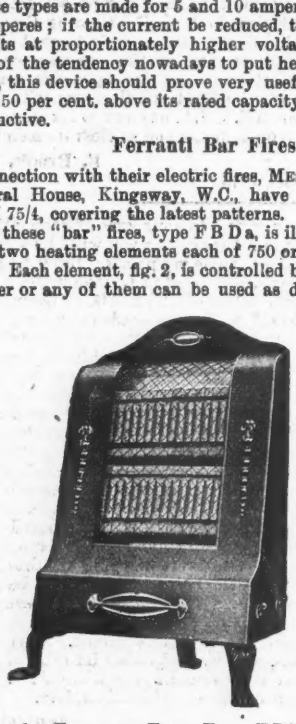


Fig. 1.—Ferranti Fire, Type F B D a.

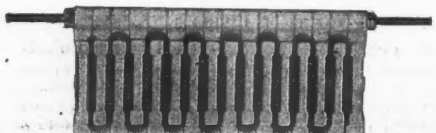


Fig. 2.—Ferranti Heating Bar.

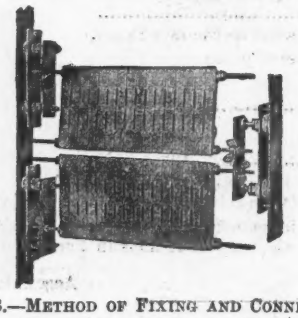


Fig. 3.—Method of Fixing and Connecting Heating Bars, seen from Behind.

Fig. 3 shows the method of carrying the elements in the carcase. The clamping bolts drop into slotted bars, which are connected to the terminals, and thus are alive. To remove an element, it is only necessary to open the main switch and slack back two wing nuts, and it is also only a few minutes' work to slacken the clamping nuts and replace the heating spiral in the porcelain supports.

The front of the fire is protected by a wire screen; the back is enclosed in the carcase, but is accessible by removing a panel.

Large Turbine Gear.

Through the courtesy of the Power Plant Co., Ltd., of West Drayton, Middlesex, we were recently able to inspect a typical turbine speed reduction gear—one of a number passing through the shops—which is intended for driving a direct-current generator and to transmit 2,250 h.p., the speed reduction being from 3,000 to 300 r.p.m.

It will be noted that the complete gear forms a self-contained unit, which is bolted to the turbine bed, an oil-tight joint being made between the caps of the turbine bearing and the adjoining pinion bearing of the gear. The latter consists of a nickel-steel pinion and built-up wheel, running with a tooth velocity of about 6,000 ft. per min; the gear face width is 32 in. and the shaft centres are 42 in. apart.

The two steel rims of the wheel are shrunk on to cast-iron centres and further secured by axial studs, the ends of which are riveted over. The wheels are bolted together at the bosses and through a distance ring near the periphery. The wheel, which is machined all over and perfectly balanced, is pressed on to a steel shaft and secured endwise in position by a collar and nut, and is also double keyed.

The gear case, as well as its base, is made in halves at right angles to the wheel axis, with planed oil-tight joints. The case is of strong box section, and the bearing housings for wheel and pinion form integral parts of the case.

The most interesting feature of the gear is the arrangement of the pinion bearings, of which there are three. The centre bearing is a plain bearing with horizontal flanges, which bolt on to flat seats on the casing. The bolt holes in the bearing flanges are clearance holes. The two outer bearings are of special design, and are arranged with a wedge adjustment for setting the gears to correct centres. When the outside bearings are being adjusted, the bolts fastening the centre bearing to its seats are slackened, so that the centre bearing can follow the movement of the outside bearings. When the latter are finally adjusted, the bolts of the centre bearing are tightened, and the bearing is fixed in its final position by steady pegs.

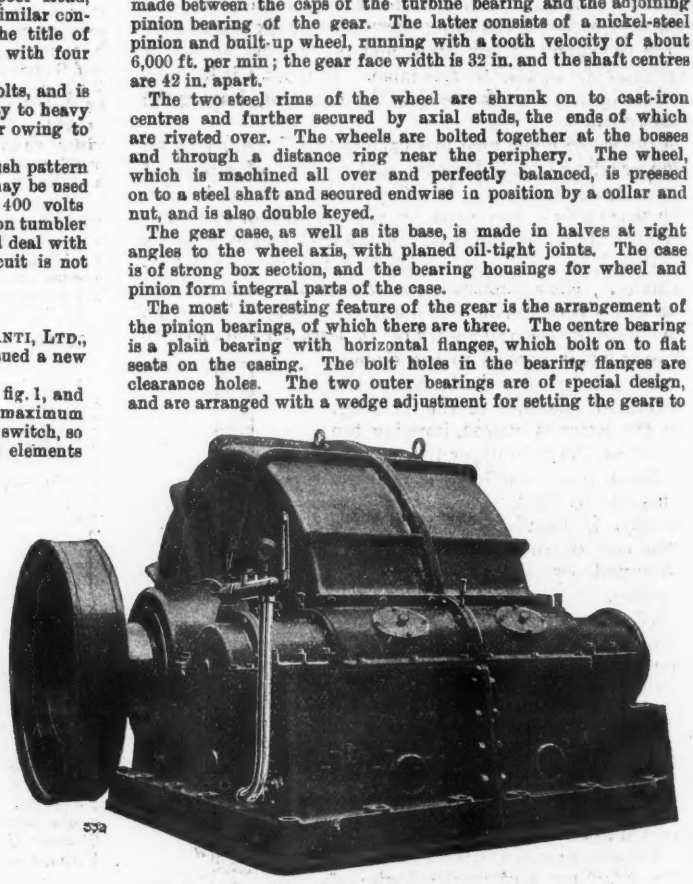


Fig. 4.—Turbine Speed Reduction Gear.

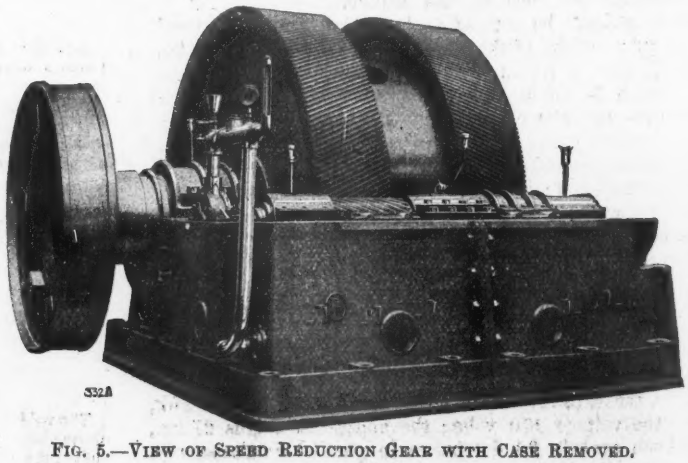


Fig. 5.—View of Speed Reduction Gear with Case Removed.

The bearings, as well as the gear, are lubricated by means of oil under pressure, supplied by a specially designed turbo oil pump coupled to the pinion shaft.

The bearings are fitted with oil-flow indicators, and a most efficient lubrication of the gear is obtained by surrounding the pinion with a closely fitting aluminium oil shield close up to the line of engagement, into which the oil is pumped, so that the spaces between the pinion teeth revolve practically full of oil. The top half of one of these shields is shown in position in fig. 5.

Special attention has been given in the designing to the accessibility of all parts; all bearings can be removed without the main cover having to be lifted, and the whole pinion can be exposed and, if necessary, taken out after removing the light end covers, which are made separate from the main cover, and are fitted with additional inspection doors.

A cast-iron oil trough is formed in the bottom of the gear case, from which the oil drains into a separate oil cooler—a cast-iron tank fitted with suitable baffles, which direct the flow of oil round a grilled copper-cooling coil through which water is circulated. The oil circuit further contains an oil strainer—arranged so that the strainer can be removed without interfering with the oil flow—pressure gauge and thermometer.

The generator is coupled to the gear by means of one of the Power Plant Company's heavy-duty flexible couplings, the flexible medium of which is in compression.

These couplings consist of two facing disks with similar cast projections, which mesh very loosely with each other, the intervening spaces being filled with compressible material. They are adopted for reversing and are insulating. We may add that the firm's works contain many examples of their own reduction gears, which are used between motors and lineshafts, and motors and machines.

Sewing Bench Lighting.

Messrs. Dugdill's Patents, of Failsworth, Manchester, have devised a "sewing bench constellum," which we illustrate herewith.

A and B are arranged for lighting button-hole machines, two lamps to each. A shows the lamps in position for use; B shows the lamps folded back, out of use. C and D are arranged for ordinary sewing machines, one lamp to each—shown in the working position, also folded back out of use. The arms are instantly adjusted, and are self-sustaining in all positions. The pillars may

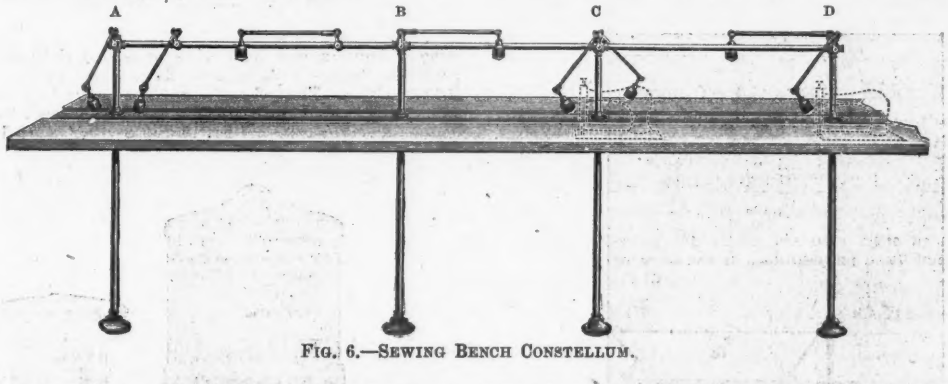


Fig. 6.—Sewing Bench Constellum.

be either screwed to the table top, or carried through felt-lined holes in the table top, and secured to the floor as shown. Constellums are made for any number of machines on one bench, and spaced as required for ordinary double-side sewing benches.

B.T.H. Lighting at West African House.

The accompanying illustrations are chosen as typical of the results obtained by the British Thomson-Houston Co.'s "Eye-Rest" indirect lighting system in one of the new Kingsway Buildings, viz., West African House. The whole of the building,

Fig. 7.—"Eye-Rest" Lighting at Martin's Bank, West African House.

including the ground floor Recruiting office, is lighting throughout on the indirect principle by Mazda lamps, in some 120 "Eye-Rest" fittings.

Part of the ground floor is occupied by Martin's Bank, fig. 7, in which oxidised silver metal fittings are used.

The wiring in West African House was already installed before the details of the illuminating scheme had been determined, and it was unfortunately arranged that all the lights in each room should

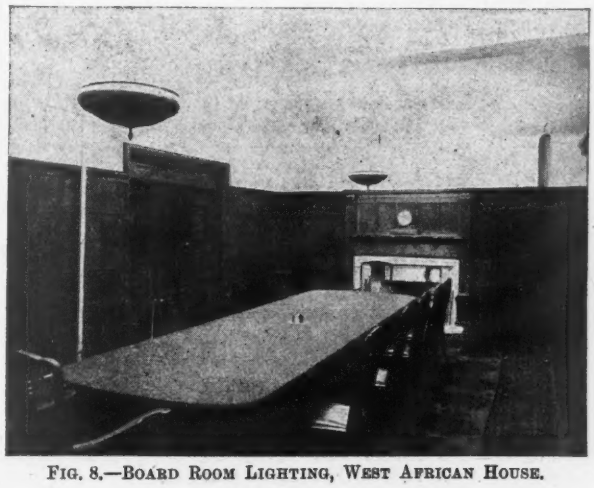


Fig. 8.—Board Room Lighting, West African House.

be turned on and off by a single switch. To overcome this inflexibility an interesting innovation has been made by providing a three-way pull chain switch in each lighting bowl where required. The pull chain permits flexible lighting from each bowl or permits all the lamps therein to be extinguished, as may be desired.

Appropriate illumination is provided in the secretary's office and agent's office by a single "Eye-Rest" fitting in each case with Mazda lamps and X-ray reflectors. In harmony with the purpose and furnishing of the board room are two handsome "Eye-Rest" fittings used to illuminate this chamber, fig. 8.

The illustrations are reproduced from untouched photographs taken by the unaided light of the Mazda lamps.

"Revo" Electric Fires.

The Cable Accessories Co., Ltd., of Britannia Works, Tividale, Tipton, have recently issued a new list dealing with their "Revo" electric fires, which are made in several patterns and finishes, ranging upwards from quite moderate prices, and which incorporate the firm's patent heating element shown in figs. 9 and 10.

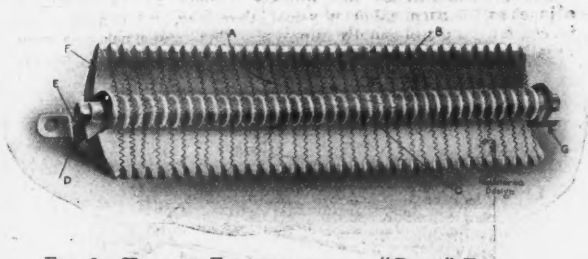


Fig. 9.—Heating Element used in "Revo" Fire.

This possesses several novel features, the heating wire B, being wound entirely on the front face of a specially-designed heat reflector F. There is a free air space round the wire which has no time lag in heating up; moreover, the member C is stated to automatically take up any slackness in the heating wires, thus preventing short circuits. D and E represent a spring device, which takes up expansion of the element and absorbs shocks, &c., in transit. Slotted end brackets G are fitted to facilitate removal.

It will be noted that the design prevents the waste of heat by radiation in a rearward direction.

Fig. 11 shows the "Leader" pattern fire, weighing 35 lb. and built for 2,000, 2,500 or 3,000 watts maximum loading.

Two switches are provided, of tumbler pattern, strongly mounted, and suitable for foot operation; the internal connections

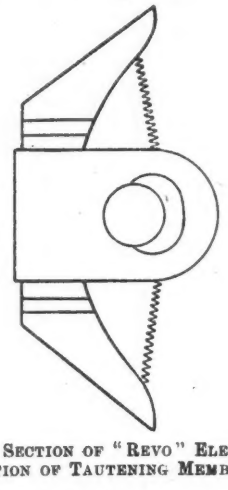


Fig. 10.—Cross Section of "Revo" Element, showing Action of Tautening Member.

are specially insulated; the housings are of fine grained cast-iror, stove enamelled and are, with the exception of the smallest fire, large enough to cover the ordinary fire grate.

Fig. 11.—"Leader" Pattern "Revo" Electric Fire.

The normal voltages supplied are 100, 200, 220, 240/250.

We note that complete spare elements and wire spirals for renewing them are supplied at trifling cost, and that the elements are guaranteed for three years.

New Electric Laboratory Furnace.

The electric furnace has quickly become an indispensable adjunct to the chemical or physical laboratory, and consequently its construction has rapidly improved. The earlier patterns were usually wound with platinum, and their cost was unduly heavy,

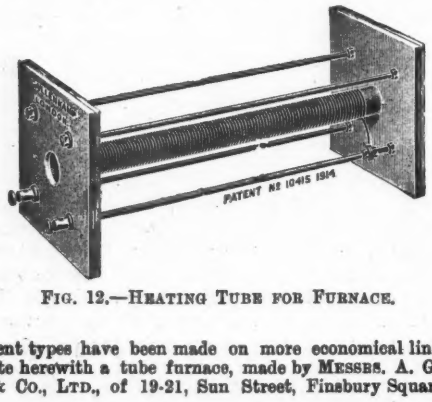


Fig. 12.—Heating Tube for Furnace.

but recent types have been made on more economical lines. We illustrate herewith a tube furnace, made by Messrs. A. Gallenkamp & Co., Ltd., of 19-21, Sun Street, Finsbury Square, E.C., which is wound with a special high-resistance alloy, which can be used for temperatures up to 1,000° C., or for short periods up to 1,100° C. The heating chamber is made of fused silica, which is not liable to breakage through sudden changes of temperature, and is a good electrical insulator. The space between the lagging and the winding is packed with finely-

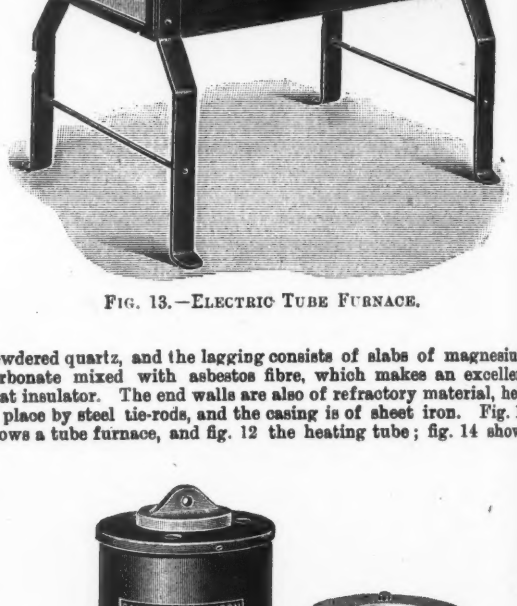


Fig. 13.—Electric Tube Furnace.

powdered quartz, and the lagging consists of slabs of magnesium carbonate mixed with asbestos fibre, which makes an excellent heat insulator. The end walls are also of refractory material, held in place by steel tie-rods, and the casing is of sheet iron. Fig. 13 shows a tube furnace, and fig. 12 the heating tube; fig. 14 shows

Fig. 14.—Electric Crucible Furnace.

a crucible furnace, with and without its cover. These furnaces work with A.C. or D.C., and can be wound for any voltage up to 220 volts. The temperature can be accurately controlled, and very little heat is radiated into the room. Muffle furnaces and other patterns are also made.

The Electric Vehicle Association of America.—The forthcoming annual convention of the Electric Vehicle Association of America, which is to be held in Cleveland, O., on the 18th and 19th inst., promises to be of an interesting character. Among other subjects of interest that are to be discussed is that of battery exchange systems, several of which are in present, or prospective, operation, and concerning which there is just now considerable discussion in electric vehicle circles. The subject will be opened by Mr. S. Ferguson, vice-president of the Hartford Electric Light Co., of Hartford, Conn., who will deal with "The Hartford Electric Co.'s Experience with the Battery Maintenance and Battery Exchange System." Another important subject is that of the electric taxicab, concerning which high hopes are entertained in some quarters. Mr. I. S. Scrimger, the secretary and general manager of the Detroit Taxicab and Transfer Co., the first concern in America to both build and run electric taxis, will read a paper on "The Electric Taxicab." Other papers to be read at the meeting include one by Mr. R. Macrea, of the Commonwealth Edison Co., of Chicago, on "The Function of the Electric Garage," one on "The Field for the Small Electric Delivery Vehicle," and one on "Electric Vehicles in Municipal Service."

DAMAGES ON BREACH OF A CONTRACT TO SUPPLY MACHINERY.

[FROM A LEGAL CONTRIBUTOR.]

Nice questions occasionally arise as to the proper course for a man to adopt who has bought machinery only to find that it does not do the work required of it. Wholesale rejection may be possible; and he may be compelled to keep the machine, work it to the limit of its capacity, and supplement it with another machine either from the same or a different manufacturer. In these circumstances it may become necessary for him to consider the measure of the damages which he is entitled to claim.

The discussion of a concrete case which may often be paralleled in actual practice should tend to the clear understanding of the legal questions which have to be considered.

A manufacturer in a tropical country where water is scarce and expensive requires a condenser which will condense 10,000 lb. of steam per hour and maintain a vacuum of 25 inches with the barometer reading 30. He buys a condenser with a warranty that it will produce these results, and erects it in accordance with the manufacturer's instructions. He then finds that it will only do half the work required of it. He makes every attempt and incurs expense in trying to put it right. He consults the manufacturers, who suggest various expedients, all of which are put to the test but without avail. If he were to stop his works, and wait for the manufacturers to comply with their guarantees, he might suffer serious loss. He therefore makes the best of a bad job—gets out of the condenser as much work as it will do and buys water to condense the rest of his steam. Finally, in order to effect the necessary condensation, he buys a second condenser from another firm which will do the work left undone by the first machine. In these circumstances—as he has suffered materially from the breach of warranty—the question is, what is the measure of damages which he can recover in an action? It is a general principle of law that "The measure of damages for breach of warranty is the estimated loss directly and naturally resulting in the ordinary course of events from breach of warranty."

What then, is the loss directly and naturally resulting from the breach of warranty? In the well-known case of *Hadley v. Baxendale* (1,854) 9 ex. 341 (at page 354) it is laid down that where two parties have made a contract which one of them has broken, the damages when the other party ought to receive in respect of such breach of contract should be such as may fairly and reasonably be considered either arising naturally—*i.e.*, according to the usual course of things, from such breach itself, or such as may reasonably be supposed to have been in the contemplation of both parties, at the time they made the contract, as the probable result of the breach of it.

But can the cost of installing a new condenser to do the work which the other was unable to do be recovered? It is submitted that it can, on the principle that a party who suffers in consequence of a breach of contract is bound to reduce the damages as far as possible. Had they simply cast out the condenser as supplied they might have been compelled to shut down their works altogether. On the other hand they chose the simpler and cheaper expedient of buying such additional machinery as they were advised to enable them to dispose of their steam.

It is interesting to inquire whether upon the cases decided in England and America damages can be claimed on the above basis. Reference is made to American decisions because notwithstanding the large number of contracts relating to machinery which are made in this country, cases illustrating the question under discussion are very rare. Indeed they mostly have to do with *delay* in the performance of a contract.

In *Cory v. Thames Iron Works Co.* (1,868) L.R. 3, Q.B. 181, the plaintiffs bought from the defendants a patent boom derrick, the first of its kind ever built in this country. It was to be delivered in six months' time, and the defendants knew the plaintiffs were going to use it in their business. It was shown in that case that owing to delay the plaintiffs lost profits which they would have made in a contract with Sir W. Armstrong. These profits the plaintiffs sought to recover when it was pointed out that the special purpose was not known. Chief Justice Cockburn, however, observed, in the course of the argument: "There is one thing which must always be in the knowledge of both parties, which is, that the thing is bought for the purpose of being in some way or other profitably applied." This case, however, is an authority for the statement that the damages are not necessarily confined to that which both parties contemplated. They may be assessed on a larger basis than that. The principle is thus stated by Sir Henry Mayne in his work on "Damages"—"Where in consequence of a change of circumstances the defendant's breach of contract has not produced full damage which the contract originally provided against, only the loss which has actually been incurred can be recovered."

Mayne also says: "As the damages for breach of covenant are measured by the actual loss or inconvenience which the plaintiff has been put to by the breach, his loss or inconvenience may from time to time vary or disappear. If by lapse of time, change of circumstances, or from any other cause, the covenant has ceased to operate, or has wholly or in part lost its beneficial character, or if its breach has been acquiesced in to a degree short of that which would bar an action, a breach may come to be measured by very small or by merely nominal damages."

In *Wigsell v. School for Indigent Blind* (1,882), 8 Q.B.D. 357, certain persons who had bought land upon which to erect a school, covenanted to build a wall seven feet high between it and the land of the vendor. Having failed to build the wall, the grantors brought an action for damages claiming the cost of putting up the wall as damages. It was shown that the fact of the wall not being built had not really affected the price of the plaintiff's land. In these circumstances it was held that, the true measure of damages being the pecuniary amount of the difference between the position of the plaintiffs upon the breach of the contract and what it would have been if the contract had been performed, under the circumstances of the case the amount that it would cost to build the wall was not the true measure of damages. In that case Mr. Justice Field said: "The rule stated in its most general terms is that plaintiff is entitled to have his damages assessed at the pecuniary amount of the difference between the state of the plaintiff upon the breach of the contract and what it would have been if the contract had been performed."

It is to the United States that we have to look for anything like definite authority for the decision of the condenser case above referred to.

In *Jacksons v. Hurlbut* (158 N.Y. 34) an action was brought to recover damages for the breaking of a planing machine while in custody of defendants, who were carriers, for transportation to plaintiffs' factory. There was a verdict of $500 for injury to the machine and loss of plaintiffs' use while being repaired. In the course of the judgment of an appeal court the following passage appears: "It was urged that the judge had admitted evidence to show loss of profits from inability to use the machine after the injury and until it was repaired. But no evidence as to loss of profits was given. Some proof was given that the plaintiff was compelled on account of the injury to the machine to send work out

of the shop in order to complete contracts they had in hand at the time of the breaking of the machine. This was not proof of the loss of the profits, but of the loss occasioned to the plaintiff by inability to use the machine on account of the defendant's negligence. We are not prepared to say that this evidence was not entirely competent under the circumstances of the case, but it is not necessary to consider this question, as the expense of restoring machine in a condition to use was a proper element in the estimation of damages, and that item of expense alone exceeds the verdict. The item of the expense of restoring the machine to a condition that would render it fit for use is certainly within the principle that damages must be compensation for the actual loss sustained which was the natural and proximate consequence of defendant's act. The cost of procuring necessary work to be done outside factory in order to enable plaintiff to fill his contracts interfered with through inability to use the machine would seem to be within same principle also."

In *Reynolds v. Braithwaite* (131 Pa. 416) it was held that when one has work done for him under a contract, exercising control of the mode of doing the work, and participating in and approving the acts of the contractor which constitute the cause of action, he is responsible for injuries resulting to another from the lawful acts of the contractor.

In an action for damages for cutting a pipe line upon defendant's land supplying water to plaintiff's premises, it was held to be legitimate to instruct the jury that the plaintiff was entitled to the reasonable cost of obtaining a supply of water, and to the reasonable cost of the depreciation thereof, from the time it was cut off. Nor was it wrong to charge the jury that the case was one in which judgment would not necessarily be limited to mere compensation. It was not a case for punitive damages, but the jury would consider whether compensating damages would be sufficient punishment for the wrong.

In a well-known American text-book, "Sedgwick on Damages" (8th edition), (Vol. 1, p. 45, note (a)), it was stated that in an action *(Davis v. Talcott*, 14 Bart. 114) to recover damages for the defective execution of a contract to reconstruct and put up machinery in a flour mill in a well-finished and workmanlike manner, and of sufficient size and strength to correspond with the cylinders, the proper measure of damages is the difference between the value of the machinery actually put up and that agreed to be constructed. In such an action the plaintiff is entitled to recover, in case the jury find that the machinery was not properly constructed, such sum as would be sufficient to put the same into condition contemplated by the contract; also such sum as the mill would have earned during the time it was necessarily delayed in consequence of the breakage in defects in the machinery, taking the fair ordinary earnings of the mill, after deducting from the gross earnings the expense of running the same, as the net profits. So, in case the contract is not performed in a reasonable time, the jury are to ascertain how long performance was unreasonably delayed, and then if they find the plaintiff was in a condition to work his mill, by having grain to grind, and is prevented from grinding the same by such unreasonable delay, the plaintiff is entitled to damages to the gross amount of the earnings of the mill, after deducting the expenses of the same.

In another American case, *Goodloe v. Rogers* (10 La. Ann. Rep. 621), it was held that in a case where it might be implied to be in the contemplation of the parties to a contract that a sugar mill and engine, which the manufacturer undertook to put up within a given time was for the purpose of getting crop, it was held that a failure to put it up in time entitled the plaintiff to recover for loss of crop and extra wages caused by delay. In another case where the lessors of a saw mill broke their contract to repair the mill, the lessees, who had a large stock of logs in the mill yard, were held entitled to recover the expenses of removing them to another mill and the cost of getting them sawn there. *(Hinckley v. Beckworth*, 13 Wis. 31.)

In another American case it was decided that where defendant breaks his contract to supply property or to do work not by altogether failing to do the thing contracted, but by doing it improperly, the plaintiff can recover no more than the cost of remedying the defect. So upon the sale of a machine which contained defects, where the defendant could have been recompensed by a small expenditure it was held that this must be done and plaintiff could not receive damages based on a recurrence of the injury. *(Frick Co. v. Falk*, 50 Kan. 644.)

Again, where the breach of warranty of machinery makes it impossible to get something necessary for use, the purchaser must minimise damages by procuring it elsewhere. So where a steam pump to be used to pump water for a greenhouse fell short of warranted capacity, the purchaser must avoid loss by procuring water elsewhere. *(Carter v. Fisher*, 121 N.Y. Supp. 614.)

Finally, where a machine was delivered in an unfit condition to do the work it was purchased for, the purchaser was allowed to recover the expenses of a reasonable but unsuccessful attempt to adapt it to the contemplated purpose *(Whitar v. Ryder*, 139 Mass. 366), and so of course of a successful attempt *(Jackson v. Hurlbut*, 158 N.Y. 34.).

Having regard to all these cases it is conceived that in the condenser case suggested at the commencement of the article, the purchaser of the machine would be fully justified in buying the new condenser and charging the cost of so doing to the account of the vendor. His alternative would be to scrap the machine and lose his sugar-crop. In the circumstances he would have chosen the course which was fairest and most economical from the point of view of the vendor.

REVIEWS.

Electrical Engineering, Volume I. Introductory. By T. C. Baillie, M.A., D.Sc. Cambridge University Press. Price 5s. net.

In his preface the author explains that this volume is designed to serve for elementary courses in electrical engineering in technical institutions, and that one of its main purposes being to teach first principles, an endeavour has been made to avoid overloading it with descriptive details which are more appropriate to oral than to written exposition.

Unfortunately, the author's endeavour has been so unsuccessful as to render his text-book exceedingly commonplace. The most flagrant example of the indiscriminate use of catalogue illustrations occurs in Chapter IV, in which, out of 33 figures illustrating "current measurement," 20 are pictures of the outsides of ammeters, voltmeters, etc., which give absolutely no information whatever as to the principles upon which the instruments depend. In fact, the only instruments of which adequate diagrammatic representation is given are of the moving coil type. Pictures of the cases and dials of electrostatic voltmeters and Kelvin's current balance are given, but no diagrams to illustrate the principles upon which they depend, while the hot-wire type of instrument is not illustrated at all. Surely, the proper place for engineering students to familiarise themselves with the appearance of ammeters and voltmeters is in the laboratory and workshop; the function of the text-book is to explain the principles of such instruments.

Nor is this fault confined to one chapter. Throughout the book pictures of apparatus abound, but effective diagrams are sadly lacking. Dynamos are illustrated by some pictures and diagrams of windings which are utterly unsuitable for the instruction of elementary students of electrical engineering. The chapter on the measurement of resistance is much better, but even here there is no need for so many pictures from catalogues.

The chapter on the potentiometer is a very good one, and the author does well to insist on the superiority of potentiometer methods in many of the important types of electrical measurement. It is, however, doubtful whether the precision type of instrument, to which so much attention is given, would be a suitable plaything for a student who needs so

many pictures of ammeters and voltmeters before he is sure of them!

Batteries are dealt with in a very satisfactory manner, special attention being given to storage batteries of both lead and Edison types. The treatment is, perhaps, a little more than "introductory," and the same may, perhaps, be said of some portions of the chapter on electric lighting. But this is better than the earlier part of the book, which could be more justly described as an "Elementary Text-book of Electricity with Pictures of some Electrical Instruments" than an introduction to electrical engineering.

Over 100 exercises are given, some completely worked out and some chosen from the C. and G. examinations, and the book is well printed and well bound. But it is not a first-rate book on electrical engineering, and we hope that Dr. Baillie will find time to re-cast some of the earlier chapters in Volume I before he publishes Volume II.—P.H.S.K.

Continuous-current Electrical Engineering. By W. T. Maccall, M.Sc., A.M.I.E.E. London: University Tutorial Press. Price 10s. 6d. net.

The reputation of the University Tutorial Press for high-grade scientific and technical manuals is considerably enhanced by the issue of Mr. Maccall's book on "Electrical Engineering." The ground covered is that of a three years' day course in continuous-current electrical engineering, and the standard reached is approximately that required for final degree examinations in engineering. It, therefore, more than covers the continuous-current section of the Grade II C. & G. examination, and is likely to prove exceedingly useful as a general handbook for shift engineers, as well as a text-book for advanced electrical engineering examinations.

The book is well arranged and well illustrated, most of the diagrams having been specially prepared for this book. The treatment is essentially practical, and many of the recommendations of the Engineering Standards Committee and of the Board of Trade rules have been included, as well as a number of useful tables. In addition to a complete treatment of continuous-current generators and motors, there are chapters on units and standards, conductors and insulators, measuring instruments, secondary cells, lighting, distribution and traction.

The chapter on conductors and insulators is a remarkably good one, the author having collected and set out in quite a short space all the essential facts concerning conducting and insulating materials. Such a complete treatment of insulators in a C.C. text-book is a very rare phenomenon. The section on measuring instruments is also very complete; and here, again, it is interesting to note a very full treatment of the Aron meter, a subject which is very often conspicuous by its absence from such text-books.

The dynamo is dealt with in five chapters, first a chapter on the theory of E.M.F. generation and armature windings, then a chapter on armature reaction and commutation, followed by chapters on characteristics, construction and efficiencies. The treatment in general is sound, but there are cases where points are laboured beyond measure, and other cases where the treatment is unduly brief. For instance, it is ridiculous to devote half a chapter to the discussion of armature reaction and then to dispose of its effect on characteristic curves in ten lines.

Three sections are devoted to electric lighting; a chapter on photometry, one on incandescent lamps, and one on arc lamps—all thoroughly up-to-date and clearly written. The section on photometry is an unusually complete exposition of the theory of illumination, and contrasts favourably with the scanty treatment usually given to this subject. There are also good chapters on cells, distribution and traction.

Throughout the book mathematical work has been kept as simple as possible, consistently with a sufficient and concise exposition of the subject. A large number of worked examples and questions are given on the subject of each chapter. These add considerably to the value of the book, both from the point of view of the teacher and the student. On the whole, we are very favourably impressed by Mr. Maccall's book, and consider that it could be used with equal advantage as a text-book for technical college classes in electrical engineering or as a general practical handbook for C.C. station engineers. —P.H.S.K.

BUSINESS NOTES.

Condensing Plant.—The Mirrlees Watson Co. have recently received the following, among other orders, for condensing plant:—

Greenwood & Batley, Ltd., for Tinsley Park Colliery.—Second set.
Scottish Central Electric Power Co., Ltd., Bonnybridge Power Station.—Second set.
Rossington Main Colliery.—Second set.
Tharsis Sulphur and Copper Co., Ltd.—Two sets.
St. Helens Corporation.—Third set.
Société Anonyme Westinghouse, Paris, for Dieppe.
Fraser & Chalmers, for North Lonsdale Iron Co.

They are also supplying Edwards air pumps for the Compagnie Francaise Thomson-Houston, and dry air pumps for the Houghton Main Colliery Co.

Catalogues and Lists.—British Thomson-Houston Co., Ltd., Rugby.—Two new price lists: No. 4,140 (8 pages) contains descriptive information, prices and weights and dimensions, arranged in the usual B.T.H. manner, of lever starting switches; No. 4.401B (four pages) is devoted to overload relays for A.C. and C.C. circuits.

The Cable Accessories Co., Ltd., Britannia Works, Tividale, Tipton, Staffs.—12-page illustrated catalogue of "Revo" electric fires whose distinctive features and outstanding advantages are described. The unit is shown in detail, and the pictures show a number of designs of these fires for office or home use. Prices are given.

Messrs. Alfred Herbert, Ltd., Coventry.—The September number of the firm's "Monthly Review of Machine Shop Practice" contains, in addition to many other matters, a long article on the machining of 9·2 in. high explosive shells. The monthly stock list of machines is not now included, but a separate weekly one is issued.

Messrs. Ferranti, Ltd., Central House, Kingsway, London, W.C.—Illustrated folder No. H.75/4 giving prices and brief particulars of various types of the firm's electric bar fires and electric cone fires.

The Cressall Manufacturing Co., 40 and 41, Staniforth Street, Birmingham.—Several illustrated descriptive lists relating to controller resistance nets, "cord" resistance material, electric heating nets, &c.

Century Electric Co., St. Louis, Mo. U.S.A.—Illustrated circular showing a number of applications of Century electric motors.

Private Arrangements.—Venner's Electrical Cooking and Heating Appliances, Ltd., 66 and 68, Wandsworth Road, London, S.W.—The following are creditors in this company, which, as already reported, has gone into voluntary liquidation:—

Barker Bros.	£95	Morris & Lister	£16
Duncan Wood, Ltd.	24	Merryweather & Co.	15
B.B. Patents Co.	73	Middleton, S.	27
Clerkenwell Plating Co.	28	Smith, W. H., & Son	29
Cope & Co.	82	Turner & Manville	31
Child & Co.	19	Venner, G.	199
Henley's Telegraph Co.	16	Venner, R. F.	98
Hateley & Bassett	19s.	Venner Signs	44
Cooper, V.	28	Watlington & Co.	15
Lewis, M.	60		

Another Lamp Test.—One of these days we shall reach the limit, and it will not be possible to find any more records for metal-filament lamps to break. Apparently we are still some distance from that unhappy time, and quite oblivious of the fact that most of the nations are at war, the lamps will persist in performing hitherto unheard-of exploits. We have not yet noted any reference to them either in the reports of Sir John French or in German wireless, but have no doubt whatever that thousands of them are rendering signal service at the Front on both sides, and after the war Victoria Cross and Iron Cross lamps will be greatly in demand. At the moment the Censor is busy, so we are deprived of the tales of heroism that should urge other lamps on to greater effort, and we have to be content with such information as is allowed to leak through from other directions. One of these pieces of information concerns an Osram lamp which gave an exhibition of strength at the Mond Nickel Institute, Clydach-on-Tawe. We have before us a picture of the said lamp shown in the waiting room of that Institute, where, as the flexible gave out, the lamp and shade fell a distance of 4 ft on to the wooden table. The shade was smashed to pieces, but the lamp was not. Indeed, it even refused to lie on the table, for it stuck upright, neither the bulb nor the filament being broken, and shortly afterwards it was switched on to a new connection and shone with its accustomed brilliance, proud of having added new laurels to the Osram fame. Of course, the point could not be seen, being in the table, but the reader can see the point of this note, namely, that Osram lamps are as strong as ever. Incidentally, it may be added that the lamp was not brought over by a Zeppelin, but is of British make entire.

Trade Announcements.—The address of the Accessories Manufacturing Co. was altered on October 4th, to Dunedin House, Basinghall Avenue, E.C. Telephone No. "City, 7149."

The Swedish General Electric, Ltd., have now moved into more commodious offices at Canada House, Kingsway, London, W.C., where all inquiries should be sent.

Messrs. G. A. Steinthal & Boydell, Ltd., of Bradford, notify that with the sanction of the B. of T. they have changed the name of the company to Jessop & Boydell, Ltd. The whole of the issued capital, excepting 12 £1 shares, is held by Messrs. Jessop, under whose management the business is carried on. The remaining 12 shares are held entirely by natural-born British subjects of British descent.

Dissolutions and Liquidations.—British Wire-Drawn Lamp Co., Ltd.—This company is winding up voluntarily, with Mr. F. J. Markie, 83, Alberta Road, Bush Hill Park, Enfield, as liquidator. A meeting of creditors is called for October 9th, at the office of Mr. O. B. Thomas, 59, Chancery Lane, W.C. Creditors should send particulars of their debts or claims to Mr. F. J. Markie, by October 18th.

Ashton & Holt, electrical and general engineers, 15, Cross Street, Ryde, Isle of Wight.—This partnership has been dissolved. Mr. F. B. Holt will attend to debts, &c.

Book Notices.—"Science Abstracts." Sections A and B. Vol. XXIII, Part 9. September 25th, 1915. London: E. and F. N. Spon, Ltd. Price 1s. 6d. each.

"*Transactions* of the Institute of Marine Engineers," September, 1915, containing a paper on "Solid Fuel from the Technical and Commercial Standpoint," by Mr. A. E. Battle, and an American paper on "The Clinkering of Coal," by Prof. L. S. Marks.

"The Royal Engineers' *Journal*." Vol. XXII, No. 4. October, 1915. Chatham: R.E. Institute. Price 1s. 6d.

"The Faraday House *Journal*" for the Michaelmas Term contains an obituary notice of the late Mr. Robert Hammond, Vice-Chairman of the Governors of the College, lists of students who are serving with the Colours, and articles on the standardisation rules of the American I.E.E., "The Cooling of Hot Bodies," by Dr. Alex. Russell, and "The Electrical Transmission of Energy," also by Dr. Russell, as well as examination results, &c.

A very comprehensive catalogue of technical and scientific books has recently been issued by the Hill Publishing Co., covering a wide variety of subjects, and giving particulars of the contents of the book in each case. Many of the books listed have been published within the past year or two. Some 35 pp. out of 117 are devoted to purely electrical subjects, but many of the books in other sections deal with matters closely allied to electrical engineering or even inseparable from it. In addition to the classified portion of the book, which ranges from "Agriculture" to "Zinc," there is an index to authors' names. Copies will be sent to readers free on application to the publishers.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXXI, Part 6. September, 1915.

"*Proceedings* of the South Wales Institute of Engineers." Vol. XXXI. September 21st, 1915. Cardiff: The Institute. Price 2s. 6d.

"Applied Mechanics." By E. S. Andrews. Cambridge University Press. Price 4s. 6d. net.

Electric Heating Apparatus.—Having purchased the stock of the late Phœnix Electric Heating Co., the Dowsing Radiant Heat Co., Ltd., are in a position to repair or supply electric heating and cooking apparatus of Phœnix manufacture.

LIGHTING AND POWER NOTES.

Aberdeen.—Station Costs, &c.—We recently referred to the financial results achieved by the electricity department during the year ended July 31st last. In this period the output sold reached 10,463,269 units, as compared with 9,663,054 units in the previous year, the power units sold during the period having increased from 4,692,626 to 5,801,989; the total H.P. of motors supplied is over 10,000. In his report on the year, Mr. Bell, the chief engineer, states that, despite the increased output sold, 1,744 tons less of fuel were consumed than in 1913-14, this being due to the use of more efficient generating plant and the better load factor obtained through there being less lighting load. This refers to the 3,000-KW. turbo-alternator installed in December, 1913, which generated 11,631,100 out of the 12,475,920 units output of the year. The fuel consumption per unit sold fell from 4·10 lb. to 3·42 lb., and the fuel cost from ·35d. to ·27d.; the total costs were also reduced from ·66d. to ·61d. per unit. The generating plant capacity was 8,380 KW., and the maximum load, including tramways, was 4,560 KW., as against 4,733 KW. in the previous year, the load factor improving to 26·19 per cent. from 23·31 per cent. The engineer remarks upon the certainty that new plant will require to be installed by the autumn of 1916-17, and on his intention to report on this matter at an early date.

Monthly Report.—The electrical engineer reports that during August 1,028,120 units of electricity were generated, an increase of 150,930 units as compared with the corresponding month last year.

Argentina.—*La Electricidad y la Maquinaria* gives the following particulars regarding electrical undertakings in the Argentine Republic. At Concordia the establishment of an electric installation has been facilitated by the enthusiastic public response to a call for capital, as much as 200,000 pesos having been subscribed in a short time. At Quemu-Quemu, in the department of Parana, a beginning has been made with the construction of the projected electric light station, and at Arequito, in the same department, the inauguration of the new electricity installation will shortly be performed. At San Pedro much dissatisfaction prevails anent the price exacted by the local electric company, so much so that the municipality has applied for a concession with a view to the erection of an opposition installation. At Madariaga also, public dissatisfaction exists on account of the deficiencies of the electric lighting service. At Pigüé (Mendoza department) the equipment of the projected electric station has been delivered, the motors having been supplied by the local agents of the Gasmotorenfabrik Deutz. At Lincoln, in the same department, the electric station which had proved a failure as a municipal undertaking, has been taken over by the Gasmotorenfabrik Deutz, under a concession for 20 years. At La Rioja the electricity installation will shortly be inaugurated, and at La Plata all the arc lamps in use have been displaced by Phillips half-watt lamps, to the number of 6,200, to the great satisfaction of the general public.

Accrington.—Showroom.—The deputy engineer is to present a report next spring upon the advisability of continuing the electrical showroom, which, pending the report, will be kept open.

Australia.—Electric Lighting Scheme.—The Wollongong (N.S.W.) Council has adopted the report of the Committee that the cost of preparing specifications for electric lighting be obtained from the consulting engineer, and that tenders be invited for the installation, on terms of payment in 10 yearly instalments.

The Heidelberg (Victoria) Council has approved of the plans, specifications and estimates for the proposed permanent works and undertaking in connection with the electric light extension, at a cost of £4,000.

The Perth (W.A.) City Council electricity department is making arrangements with the electrical contractors for the supply, and, where advisable, the fixing of new A.C. motors and equipment for elevators, to replace the present D.C. appliances.

Electric Pumping.—The engineer-in-chief of the Sydney (N.S.W.) Water and Sewerage Board has recommended that new electric pumps and motors be installed at Marrickville pumping station, at a cost of £3,850, to deal with flood waters, as the engines formerly in use are not now available; also, that electric power be obtained from the City Council, at 1½d. per unit.—*Tenders.*

The Western Australian Legislative Assembly has passed the second reading of the Bill empowering the Government to override the Fremantle municipality's powers and supply electricity in its territory. Fremantle has spent £150,000 on electric tramway and lighting plant, and claims that it would be involved in a loss of £25,000 if the State competition was authorised.

It is stated that the Government offered to supply current at a cheaper rate than Fremantle could produce it at.

The Queenscliff (Vic) B.C. has decided to borrow £4 500 for an electric light and power plant.

The first annual report of the Nundwading (Vic.) Shire Council electricity undertaking shows total receipts amounting to £1,405, and expenditure of £1,349, leaving a credit balance of £56. The total installation costs amounted to £9,083; 482 private consumers have been connected, although it was estimated that there would only be 150 consumers at the end of the first year.—*Melbourne Age.*

The installation of the Coonamble (N.S.W.) municipal E.L. scheme has been commenced; the plant will consist of a 100-H.P. suction gas engine and generator, with three-wire distribution. A Tudor battery will give a 24-hours' stand-by. The total length of cable to be laid is about 31 miles; street lighting will be provided by 60 lights, ranging from 100 to 200 C.P. in the outskirts and to 1,000 C.P. in the main thoroughfares. The total cost is estimated at £6 000.

Barking.—Loan Sanction.—The U.D.C. has received sanction to loans amounting to £13,654 for extension of the electricity works. As the L.G.B. cannot sanction a loan for buildings until revised estimates based on tenders are submitted, the surveyor has been instructed to prepare plans and specifications, and invite tenders.

Barnet.—Infirmary Lighting.—At the meeting of the Guardians last week as to the electric lighting for the infirmary, it was stated that a saving of £800 might be effected by putting off the execution of works that had been contemplated, and this was agreed to.

Bedford.—Annual Report.—The accounts of the Corporation electricity undertaking, for the year ended March 31st last, show that the total expenditure (including war allowance and bonus, £163) was £14,851; the total income was £28,076, and the gross profit carried to net revenue account was £13,225. After the payment of £6,915 for loan charges, there was a net profit of £3,610, of which £1,610 has been transferred to the reserve fund, and £2,000 to the general district fund for the relief of rates. During the year 3,831,340 units were generated. Of these, 276,794 units were sold for public lighting, 247,416 units for pumping, 670,016 units for private lighting, and 1,871,456 units for power, making the total number of units sold 3,065,682; the maximum load was 800 KW.

Belfast.—Home Office Inquiry.—The Tramways and Electricity Committee has applied to the Home Office to hold an inquiry into the circumstances connected with the recent fire at the power station and the accident to one of the turbo-alternators.

Birkenhead.—Price Increase.—The Electricity Committee has recommended the T.C. to increase the price of current to ordinary consumers for lighting and power by 2½ per cent.; and to prepayment meter consumers outside the borough by ½d. per unit.

Broadstairs.—Price Increase.—The U.D.C. has been informed by the Isle of Thanet Tramways Co. that, from October 1st, the price of electricity will be increased by 10 per cent., owing to the serious increase in the cost of materials. The directors are to consider whether the increase shall apply to current consumed by the Council as well as to private consumers.

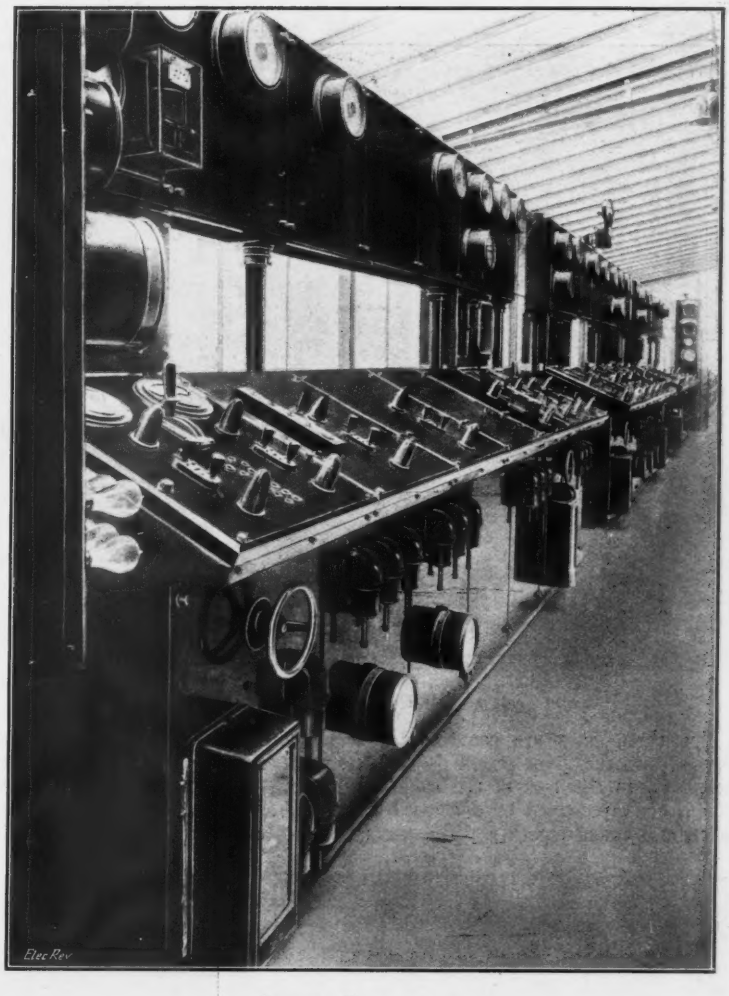
Callan (Co. Kilkenny).—Proposed Workhouse Lighting.—A proposal to install electric lighting in the workhouse has been postponed pending a conference as to the proposed amalgamation of the Union administrative area with neighbouring areas.

(*Continued on page 467.*)

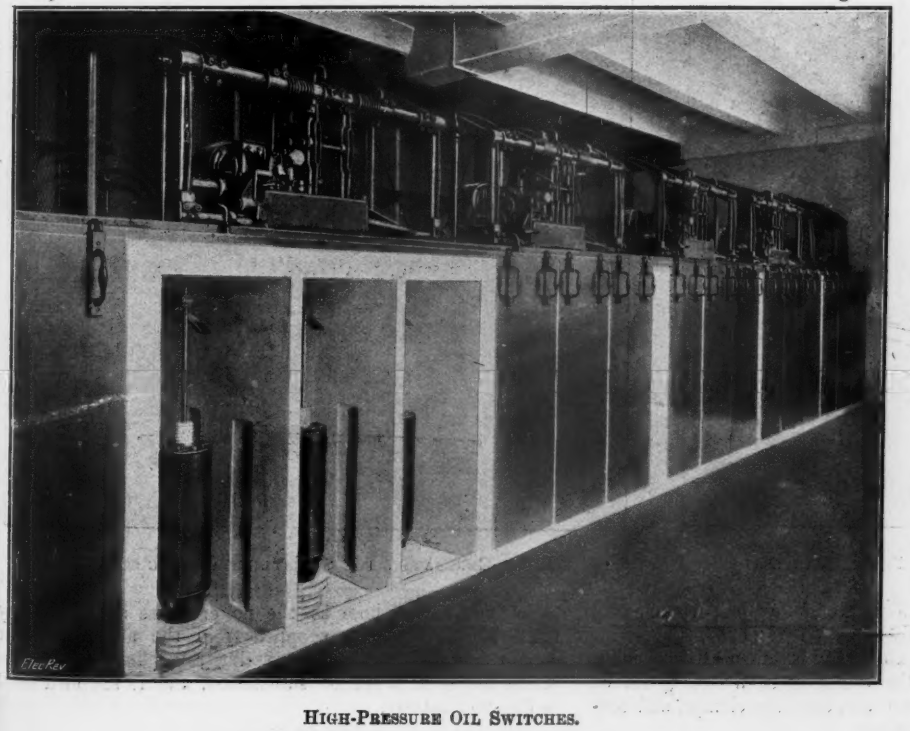
LONDON AND SOUTH-WESTERN RAILWAY ELECTRIFICATION.

(*Continued from page* 432.)

The switchgear is installed in a separate bay, which runs the whole length of the turbine house, and includes accommodation for the engineering staff, offices, stores, &c., at the permanent end of the building. This bay is 21 ft. 6 in. wide, and the switchgear is arranged on three floors. The high-pressure gear is of the remote control type, and is divided into three groups; a view is given herewith of the control board, which is situated on a gallery overlooking the turbine room. The group bus-bars are connected to the main or interconnecting bus-bars through oil-switches, fitted with an automatic maximum release, with a time element. The cable boxes and transformers are on the turbine-house floor level, the oil switches and operating mechanism on the first floor (on which is also the control room), and the bus-bars on the second or top floor. The auxiliary switchboard for the 220-volt D.C. supply is situated in the switch-room adjacent to the main control board, and the feeder panels are illustrated on p. 464, the generator panels being at the right-hand end. The high-pressure oil-switches are enclosed in fire-proof compartments, as shown in the view below, and with the rest of the switchgear were made by the British Thomson-Houston Co., Ltd., of Rugby. In these switches the main current-carrying contacts are outside the oil-tank, only the final break being taken in the latter. The isolating switches can be seen in the background of the view, in compartments guarded by metal gratings. The oil-switches shown include generator, feeder and interconnecting switches. Lightning arresters and earthing resistances are provided on the lower floor.



Control Benchboard.

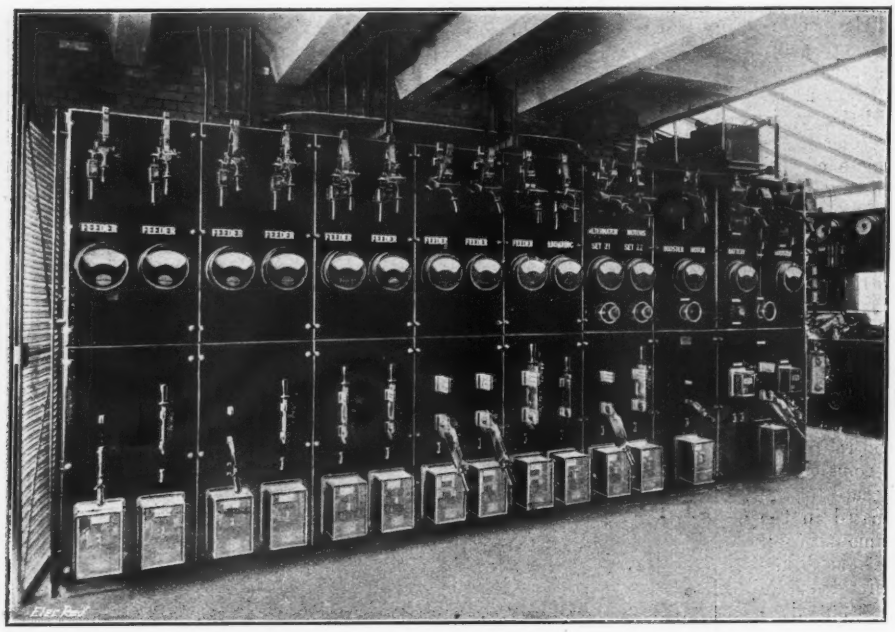


High-Pressure Oil Switches.

Current at 11,000 volts is distributed from the power house to the sub-stations by means of three-phase paper-insulated, lead-cased and heavily wire-armoured cables, manufactured and laid by Messrs. Siemens Bros. & Co., Ltd. The cables are generally run above ground, being hung on cast-iron brackets bolted to creosoted wood posts 5 ft. 6 in. apart. Where the cables cross the running lines at level crossings and other special points, they are laid underground in Howard asphalt troughing.

The fact that the feeders are supported on posts by the side of the track called for special provision to be made to prevent any trouble due to expansion and contraction; change of temperature might cause in this way considerable

strain on the joints. The type of joint adopted to meet this was a modification of Messrs. Siemens's standard practice for mining cables, which combines efficient bonding of the wires with mechanical strength and protects the joint from strain.

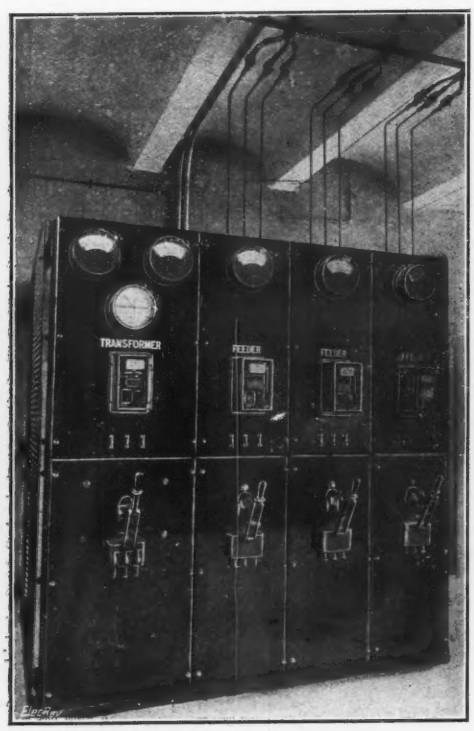


Direct-current Feeder Switchgear.

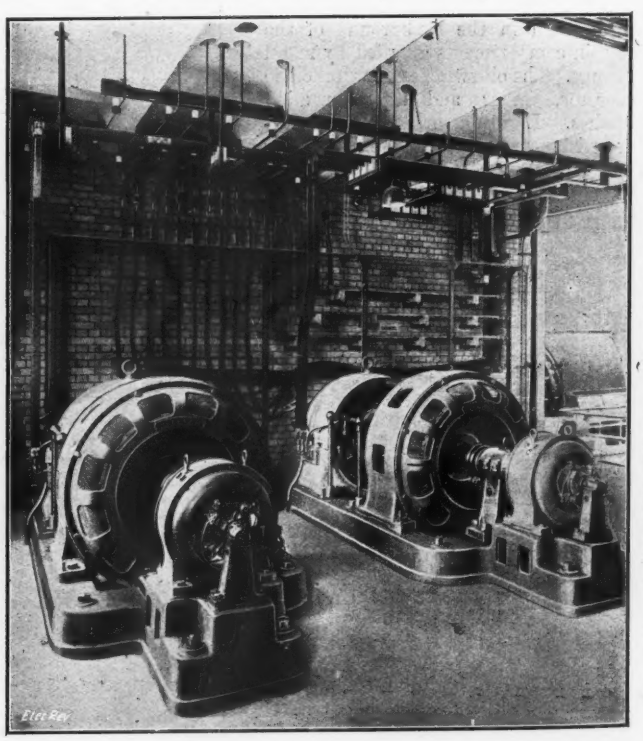
The three cores are connected by extra long copper sleeves, and the joint proper is enclosed in a lead sleeve wiped on to the lead of the cable in the usual manner. This sleeve is protected by a pressed steel cover, made in halves and bolted together. The armour wires are held at each end of the cover by a pair of heavy cast-iron clamps, which are bolted together by two long bolts, the latter being tightened up until all strain is taken off the joint. An additional bonding of the sheathing is effected by tinned brass plates, placed between the cast-iron clamps, and connected by a tinned copper strap.

The cables are designed for a working pressure of 11,000 volts, and were tested at the works with a pressure of 25,000 volts for half an hour, and on site after laying and jointing with 20,000 volts for half an hour. Finally, each cable is required to be switched on and off 10 times under any working condition. Altogether upwards of 80 miles of three-phase cables of various section have been supplied by Siemens Bros. & Co., Ltd., the sizes being 0·2, 0·15, 0·1 and 0·06 sq. in.

The sub-stations, passenger stations, goods yards, and sidings between Waterloo and Clapham Junction, and on the "Kingston Roundabout" line, will take their lighting supply through a separate cable, which will also serve for supplying power in connection with the track circuit signalling arrangements. Single-phase alternating current at a pressure of 3,300 volts is supplied through this cable to transformers placed in small brick chambers built at intervals along the route, the pressure being transformed down to 220 volts. The 3,300-volt supply is obtained from frequency-changer sets situated at the power house and at Waterloo, Clapham Junction, Raynes Park and Twickenham. To ensure an absolutely reliable supply, three motor-generator sets are also provided. Those at the power house are driven by 220-volt D.C. motors, supplied from the auxiliary plant and storage battery, and are illustrated herewith. The third set is at Waterloo sub-station, and is supplied from a 600-volt battery.



Transformer and Feeder Panels.



Motor-Generators for Signalling and Lighting.

(*To be continued.*)

THE WORKS OF ELECTRO-GALVANIZERS, LTD.

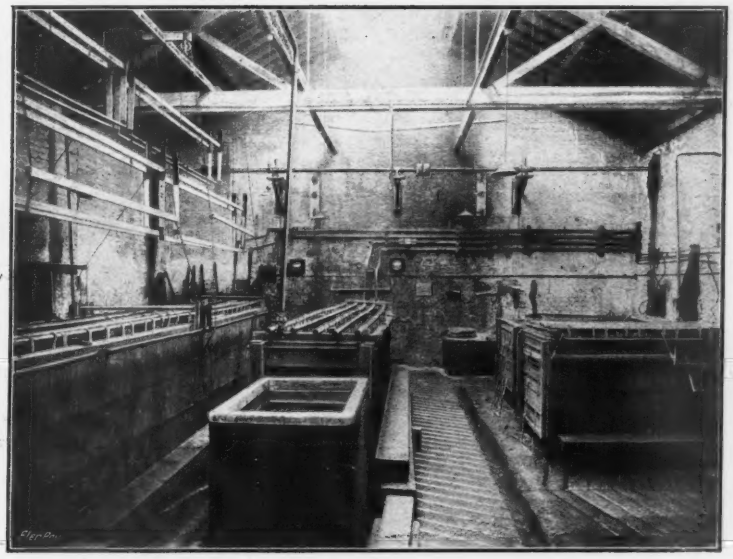
For many years the only commercially successful method of applying a rustless protective coating of zinc to iron and steel work was the old dipping process, *i.e.*, hot galvanising. This process has many limitations as compared with modern electrolytic methods of producing the zinc coating, not the least being due to its high temperature, but this difficulty is avoided by the "cold" electrolytic processes. Moreover, electrolytic zinc, properly applied, is denser, tougher, more uniform and more resistant against corrosion.

One of the most advanced methods of electro-deposition is that worked by Electro-Galvanizers, Ltd., of Stratford, E., whose works and methods are briefly described in this article.

The preliminary processes—usual in work of this description—are designed to thoroughly clean the surfaces on which deposition is to take place, and consist of pickling in hydrochloric or sulphuric acid, and subsequently sand-blasting the surfaces with silver sand, for which purpose a compressed-air plant and sand apparatus is provided.

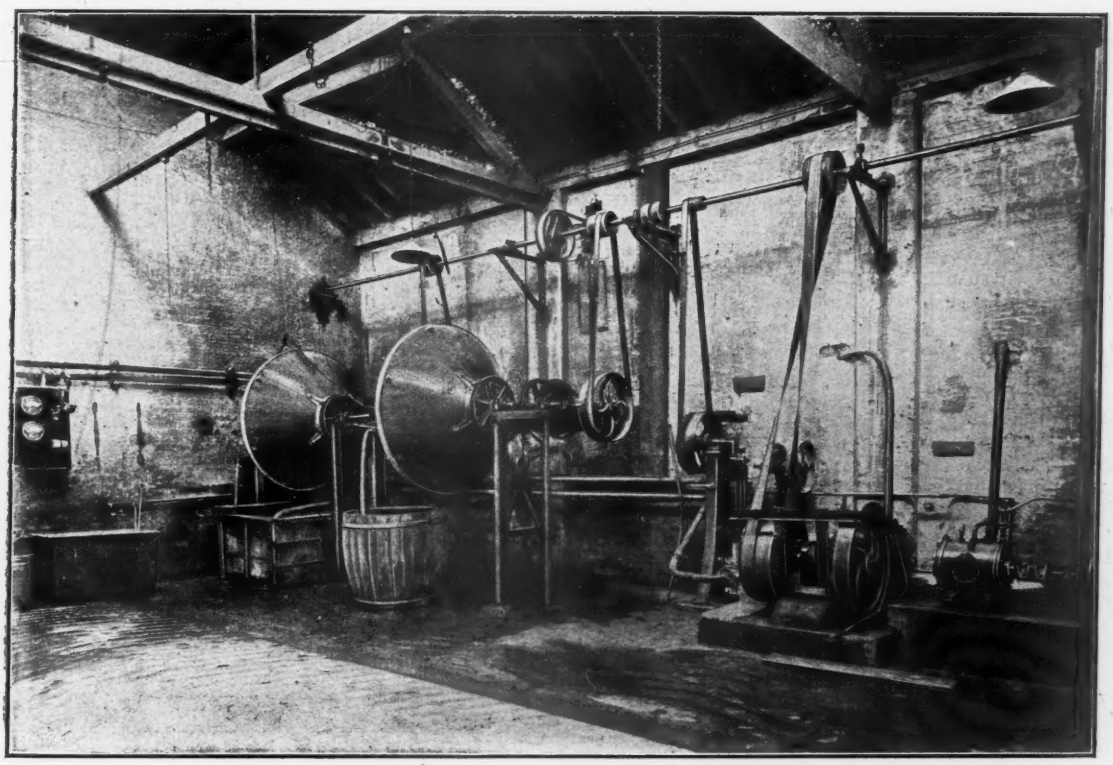
The smaller articles are then passed to rotary vats or rumblers, and the larger ones to ordinary stationary vats for the depositing process. The process used by Electro-Galvanizers, Ltd., represents a marked advance on ordinary electrolytic deposition processes, both in time and cost; owing to the special salts used in the bath, the latter is rendered regenerative, the anode being dissolved *pro rata* with the amount of metal deposited from the salts in the bath, a feature which cheapens the cost, as it is less costly to renew the anode than the salts. When there is no current passing the bath is inactive, and there is no dissolution of the anode.

Again, due to the low resistance of the bath and low voltage employed, no electrolysis of water occurs, and no hydrogen is generated on the cathode, on which the metallic deposit is made, and obviously that perfect uniformity of surface, which is the aim of all depositing processes, whether protective or decorative, can be more certainly ensured. By this process it is possible to pass 500 amperes per square yard of surface, while by ordinary processes 100 amperes is a maximum, so that the process attains practically the theoretically possible 1·2119 grm. of zinc per ampere-hour deposit.



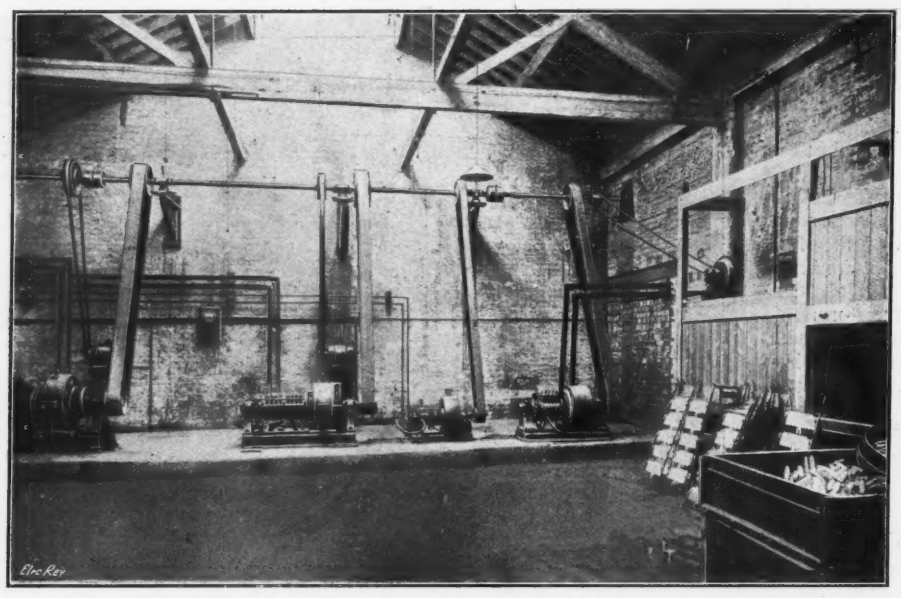
Depositing Shop, Electro-Galvanizers, Ltd.

A particularly interesting feature of the works is the shop given up to wire and strip galvanising, the strip being used chiefly for sheet-metal stampings, for which it is completely successful owing to the ductility and tenacity of the deposit.



Rotary Depositing Vats at the Works of Electro-Galvanizers, Ltd.

This is a continuous process, the strip or wire being unwound from iron drums, and drawn, at a speed of 2 or 3 ft. per min., through a potash bath, to dissolve any oil or grease; then through a water bath to wash off the potash, and through an acid bath for pickling, from which it passes to a cleaning roller and to a final water bath for cleaning off the acid. The strip or wire then passes into the zincing bath, being drawn between two horizontal anodes; owing to the high rate of deposition, only some three minutes is taken in passing through this bath, and the strip or wire is then passed through a water bath, and finally wound on to "finished" drums.



Low-voltage Dynamos, at the Works of Electro-Galvanizers, Ltd.

A special bath is used for large work, and we understand that the firm are prepared to put down special baths if necessary to meet exceptional requirements, and can undertake work up to 20 ft. long.

Five low-voltage generators are employed in the works, driven by motors supplied from the West Ham Corporation's mains; the machines total 67·5 kw., the working voltage being usually 6 volts.

Owing to the very fine surface of deposited metal which can be obtained and the fact that the latter is molecularly combined with the base on which it is deposited, this process of galvanising has already attracted considerable attention for high-grade work—which, in fact, cannot be satisfactorily done by other means.

In particular, mention may be made of the value of this process for screws, bolts, nuts, pipe unions, &c., where it is important that the gauge of the threads shall be unaltered by the deposit, as happens in ordinary galvanising, when, frequently, subsequent use of stocks and dies removes the zinc coating.

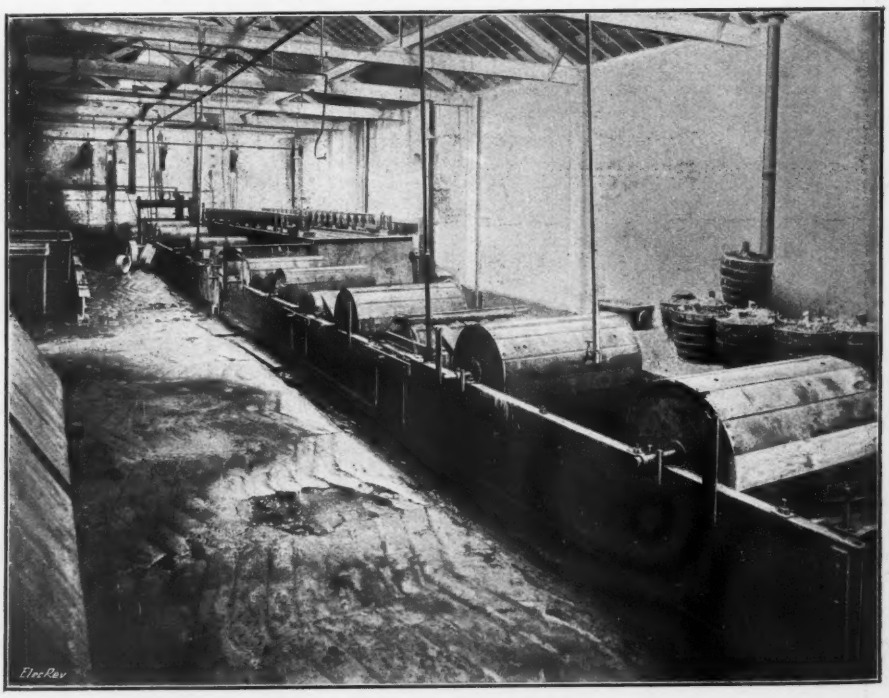
Owing to its being a cold process, the temper of steel springs is unaffected, and, owing to the fine deposit obtainable, electrical resistance grids can be galvanised without altering their electrical properties.

Although the bulk of the work undertaken at the moment is the deposition of zinc, the firm's patents cover a variety of processes for deposition on all metals, porcelain, wood, &c., in zinc, lead, tin, copper, nickel, silver, aluminium, and various alloys; indeed, we understand that they intend to develop at an early date their patent processes for the nickel plating of zinc, an industry which has in the past been practically in German hands.

Another direction in which one may anticipate extensive developments when industrial conditions again become normal, is in the electroplating of china and glass.

Until recently the provision of a metallic surface on such substances by electrolytic methods has only been possible by establishing conduction through the coating of the surface of the glass or china with graphite or plumbago in a solution of varnish, rubber, &c., in which case, of course, the metal is not in direct contact.

By the firm's processes it is possible to deposit metal direct on the glass, &c., the deposit being an integral part of the base and inseparable from it, which has obvious advantages. The process has also been applied successfully to the deposition of silver-nickel alloy, which combines the whiteness of silver with the durability and non-tarnishable qualities of nickel. Many beautiful examples of this work were exhibited by the company at the recent Board of Trade Exhibition, and we had the opportunity of viewing them at their offices and showrooms, at 16, Green Street, Trafalgar Square, W.C. Our various views give some indication of the operations of the firm at Stratford.



Wire and Strip Galvanising Shop.

LIGHTING and POWER NOTES.

(*Continued from page* 462.)

Castletown Berehaven.—The District Council has accepted the tender of Mr. P. H. Nugent, Bantry, for the lighting of Castletown Berehaven by electricity, at £70 per annum, the works to be maintained for 15 years. The initial cost will be about £1,500, and the number of lights will be 14 of 100 C.P. and four of 32 C.P. each.

Continental.—Switzerland.—Statistics published in the *Bulletin Technique de la Suisse Romande* relating to the hydraulic power utilised in that country show that at the end of 1913 there were seven installations of more than 10,000 H.P., having a total mean output of 127,500 H.P.; nine of 5,000 to 10,000 H.P., aggregating 86,840 H.P.; 41 of 1,000 to 5,000 H.P., aggregating 139,020 H.P.; and 214 of 100 to 1,000 H.P., aggregating 90,507 H.P.; as well as no fewer than 6,528 installations of less than 100 H.P. The total average power utilised is given as 518,433 H.P.

Coniston (Lancs.).—E.L. Scheme.—The building of a generating station by the Coniston Electric Supply Co. has commenced, and poles for the overhead lines are being erected.

Darwen.—Loan Application.—The Corporation has decided to apply to the L.G.B. for sanction to the borrowing of £3,000 for mains extensions and services.

Derby.—Loan Application.—The Electric Lighting Committee of the T.C. has recommended application for sanction to a loan of £3,000 for mains and motors required exclusively for Government purposes; the provision of a cable at a cost of £300 for the supply of current to Messrs. Eastwood, Swingler & Co., and the construction of an overhead line to supply current to the London Road branch library.

Ellon.—E.L. Scheme.—The formal inauguration of the electric supply took place on Saturday. Provost Ruxton presided, and said they were under a deep debt of gratitude to Mr. Duncan, of Tillycorthie, for installing the electric light.

Erith.—Loan Sanction.—The U.D.C. has received L.G.B. sanction to a loan of £15,690 for plant at the electricity works (repayable in 16 years), and of £2,400 for buildings (repayable in 30 years).

Faversham.—Price Increase.—The T.C. has increased the price of electricity as from November 1st by ½d. per unit.

Glasgow.—Last week the members of the Corporation inspected the works in progress at Dalmarnock in connection with the new power station. The inspection was mainly confined to the arrangements for the intake of water from the Clyde to the screening house. Six screens have been constructed, each capable of passing 50,000 gallons of water per minute. The foundations of the turbine room and boiler house were also inspected. Owing to the war, difficulty in obtaining workmen had to some extent arrested the progress of the work, but sufficient advance had been made to indicate the vast proportions of the undertaking and of the intricate nature of the operations involved. It is proposed to complete the undertaking in two sections; the portion now under construction was contracted for prior to the war, the cost including £50,000 for excavations and £25,000 for coal-handling plant. It is not intended to place the contract for the building or issue specifications for the first instalment of the machinery until after the war.

The electricity department, with the co-operation of the local electrical contractors, has opened showrooms opposite the Royal Glasgow Institute of Fine Arts in Sauchiehall Street, for the display of electric cooking, heating and domestic appliances; daily demonstrations of cooking by electricity will be given.

Halifax.—Loan Application.—The L.G.B. is to be asked to sanction the borrowing of £2,000 for expenditure on new electricity mains to factories engaged on Government contracts.

The Halifax Y.M.C.A. (Military) is to be supplied by the Corporation with electricity for the hut at Ward's End for a further period of six months at half price.

Heckmondwike.—Bulk Supply.—Owing to the increased cost of coal, &c., there is likely to be a big deficit as a result of the year's working of the Corporation electricity department, and, with a view to reducing this as far as possible, an arrangement has been made by the authorities with the Yorkshire Electric Power Co. for the purchase, during a given period, of two-thirds of the current used by the Council. It is believed that a substantial saving to the electricity department will result.

Houghton-le-Spring.—Overhead Line.—The U.D.C. has consented, subject to adequate guarding, to an overhead electrical transmission line being erected at Rainton Bridge by the Lambton and Hetton Collieries, Ltd.

Ingleton.—Village Lighting.—In connection with the new model village which is springing up around the new colliery at Ingleton, a request has been made to the local Council that the houses—of which there are at present 60, to be increased to over 100 soon after Christmas—should be lighted, and the Council has appointed a deputation to wait upon the local Electric Lighting Co. in regard to the matter.

Ipswich.—Year's Working.—The annual report of Mr. Frank Ayton, chief engineer, on the working of the Council's electricity undertaking shows that this has suffered considerably from the prevailing conditions, due to loss of staff, delay to completion of the extension in the Eastern district, falling off in lighting and power business, and failure to realise the benefit of more efficient working, due to the increased cost of fuel, &c. The year's revenue, £27,886, was rather higher than in the previous year, and the gross profit, £10,601, compared with £10,309 in 1914. The capital charges were on an increased scale, but after meeting the usual charges, a net balance of £342 remained. Actually, however, the department paid £1,199 extra out of revenue on capital items, the net result being a call on the reserve fund of £857. The total units sold were 2,966,968, as against 2,829,086 in 1914, power units—the largest item—totalling 1,514,351, as against 1,382,203. The maximum lighting and power load was 1,400 KW., and traction load 445 KW.; 616 motors of 3,264 H.P. were connected to the mains. The station plant capacity was 3,511 KW., and 5·39 lb. (as against 5·47 in 1914) of fuel were used per unit sold. A further 50 street gas lamps were changed over during the year to electric light, making a total of 236 street lamps lighted electrically.

Keighley.—Year's Working.—The borough electrical engineer's report on the last year's working of the electricity department, showed a net profit of £1,024. The cost of fuel had been £5,180, an increase of £1,020 as compared with 1913-14, the extra expenditure being accounted for by the Yorkshire miners' strike and the increased cost of cartage. The revenue from the undertaking during the year amounted to £18,393, as against £15,741 during the previous 12 months. The works costs totalled £10,380 (£6,739), and standing costs were £6,988 (£1,775). There was a gross profit of £8,013 (£7,277), and a net profit of £1,024 (£1,204). The average price obtained from sale of current was ·82d. per unit.

Llandudno.—A Lighting Prosecution.—Recently the assistant electrical engineer and the deputy chairman of the Council were charged under the Defence of the Realm Act, the former with switching on certain public lamps, visible from the sea, and the latter with procuring the commission of the offence. The evidence showed that the lamps were lighted in response to a request of the Commanding Officer of a battalion which had to march along the dark road to the railway station; and that the deputy chairman telephoned the engineer to light a few lamps. The lamps being in series, it was necessary to light more than those specified. The case was dismissed; the chief constable of the county explained that neither the Council nor military Commanding Officers could order lighting visible from the sea, but only a special military officer appointed for the district.

London.—Hackney.—The accounts of the Council's electricity undertaking for the year ended March 31st last show a total income of £59,003, as against £58,939 in the previous year; and total expenditure of £27,118, as compared with £27,816, leaving a gross profit of £31,885, as compared with £31,122. The gross profit represents 7·1 per cent. upon the mean capital expenditure employed during the year. After meeting loan and bank interest charges amounting to £26,047, there remains a surplus of £5,838, which, compared with £8,124 for the previous year, shows a decrease of £2,286. Of the surplus, £1,460 has been expended on meters, £887 for war allowances, and the balance with £120, the profit from the sales department making £3,611, is available for the relief of rates. The balance is greater by £1,659 than anticipated in the amended estimates, and is largely accounted for by the fact that the final meter readings were recorded later than usual owing to the shortage of staff; in view of this fact and the increased cost of coal, &c., the Electricity Committee considers that £1,500 of the profit should be carried forward to meet contingencies in 1915-16. The reserve fund now stands at £30,680. The average price per unit obtained for private lighting and other domestic uses was 2·85d.; power and factory lighting, 1·01d.; destructor supply, 0·75d.; public lighting, 1·13d.; all purposes, 1·50d. The total generating and distributing cost per unit was ·67d., as against ·70d. in 1914. The total number of motors installed at the end of March, 1915, was 1,270 of 7,868 H.P., an increase of 15 per cent.; the number of units generated during the year was 10,402,380, of which 669,051 units were used for public lighting, 158,615 units for the refuse destructor, 2,371,670 units for private lighting, heating, &c., 5,737,460 for power; the total units sold were 8,936,796. The maximum load was 4,597 KW., and the load factor 22·19 per cent.

Islington.—Workhouse Lighting.—The Guardians have decided to take the current for lighting their institutions from the B.C., instead of manufacturing it themselves. The price quoted by the Council is a flat rate of 2d. per unit, as against the Guardians' claim that they made their own current at under 1½d. per unit. To install the supply from the Council will cost £500, as against £700 for putting the existing battery and plant at the infirmary into order.

St. Marylebone.—Price Increase.—The Electricity Committee of the B.C. recommends that the charges for the supply of electricity to consumers be increased by 10 per cent., to take effect from the date of the readings of the meters for the September quarter.

Northampton.—Price Increase.—The local E.L. and Power Co. announces that from Michaelmas Day the price of energy will be temporarily advanced by 7½ per cent. for power, and by 10 per cent. for lighting and heating.

Manchester.—Barton Scheme.—The Rivers Committee recently appointed a special Sub-Committee to formulate a complete scheme for the provision of cooling water at the new electricity generating station at Barton. The report has now been prepared and approved by the Rivers Committee, and has been presented to the Corporation Finance Committee.

Sanction has been received to the borrowing of £10,750, repayable within 15 years, and £4,730 repayable within 10 years, in connection with the new Barton generating station.

The E.L. Committee has entered into an agreement with the British carbide factory for a supply of electricity to the works.

New Zealand.—The Napier B.C., on the recommendation of its engineer, has decided to increase the plant at the electricity works by the installation of two 400-H.P. producer-gas engines; at the present time the overload sometimes reaches 40 per cent., and there is no stand-by. The new plant is expected to be running by April next.

Preston.—The B. of G. has decided to accept an offer of £500 for one of the electric generators at Fulwood Workhouse.

Rotherham.—Proposed New Plant.—Additional plant to the extent of 5,000 kw. is needed at the Corporation electricity works, and the Government has been asked what assistance can be given if the additional plant, estimated to cost £20,000, is purchased.

Stretford.—Price Increase.—Owing to the increased cost of coal and other materials the charges for electricity are to be increased by 15 per cent. from November 1st.

Wimbledon.—Proposed Loan.—The Electricity Committee has recommended the B.C. to apply to the L.G.B. for sanction to borrowing £5,020, to meet excess expenditure and to provide for the estimated expenditure on mains, house services, meters, and transformer sub-station, during the period ending March 31st, 1916.

The Committee also recommends that notice be given to consumers of electrical energy who are supplied at special contract rates, of the Council's intention to terminate the existing arrangements as to the supply.

Worthing.—Price Increase.—The Electricity Committee of the T.C. has decided, owing to the situation caused by decreased consumption due to restricted lighting, to increase the charges for current by 10 per cent., making a charge of 5½d. per unit for private houses, shops, &c. This will, it is estimated, produce £500 additional revenue.

Yarmouth.—Price Increase.—The T.C. has increased the price of current for lighting from 5d. to 5½d. per unit, and has decided that all current supplied for power will be strictly net.

TRAMWAY and RAILWAY NOTES.

Accrington.—The Tramways Committee has considered an application from the tramway employés for an increase of wages, and has recommended an increase of ½d. per hour, commencing with the first week in October. A similar application from the electricity department has been referred to a Sub-Committee.

The Rawtenstall Corporation has informed the Council of its willingness to continue the existing through-running arrangements for a further period of 12 months. The agreement is to be continued.

Argentina.—Difficulties have arisen in connection with the 50 years' municipal concession to the Compania Italo-Argentina de Electricidad for the installation of electric tramways in the city of Dolores. In the first place, the Municipality not having power to make a concession for a longer period than 20 years, sought confirmation for the longer term from the Legislative Council at Buenos Ayres. In the course of the consideration of the petition, it transpired that the company was pledged to make a refund of 2 per cent. of the receipts at the end of 20 years for the electric tramways alone, whereas the concession also included the right to supply power and light in Dolores. This, the Legislative Council held, argued lack of business perception on the part of the Municipality, and in the upshot the concession was relegated to the Commission of Public Works for investigation and report.

Australia.—According to the *Melbourne Age*, the Greater Melbourne Council Bill which has passed the second reading, is not to be proceeded with at present owing to the diversity of opinion amongst members of the Legislative Assembly as to whether the tramways should be under municipal management or be nationalised. It is proposed to provide for the carrying on of the present tramway systems after the expiry of the company's lease on July 1st, 1916, and a temporary Tramways Bill is to be introduced appointing a Government Tramways Trust to expire on October 31st, 1917, or at such earlier date as Parliament should determine.

The estimated cost of the White Bay power house when fully equipped with machinery is £1,360,000; the sum already expended amounts to £475,386.

Bradford.—Year's Working.—The annual accounts of the Corporation tramways, the financial results of which have been previously referred to in these columns, show that the route mileage open was 59 miles of tramways and 9¼ miles of railless traction. The car-mileage for the year was 6,371,710, being an increase on the previous year, as also were the passengers carried and total receipts, 70,077,271 and £329,888 respectively. The ratio of expenses to receipts increased from 73·138 to 74·6 per cent., but the net profit reached £32,442, as against £29,447 in 1914. During the year the Bingley extension was opened for traffic; the Baildon extension is being held up till after the war. The report refers to the railless traction routes, pointing out that these act as feeders to the tramways, and that tramways could not have been adopted because of the heavy capital expense. The average working expenses per car-mile were 6·557d., as compared with 7·286d. in 1914; the traffic revenue was 5·83d., as compared with 7·281d.; about 178,000 miles were run during the year, the average fare charged being ·65d. per mile. Plans have been submitted and approved for a central tramway terminus in Forster Square, with an island platform and shelter. The report refers to the new power brake which has been fitted to 75 cars, and points out that the average cost of drivers' accidents on all cars over a period of four years amounts to £3 11s. per car per annum, while the cost in the case of cars fitted with the new brake is 3s. per car per annum; there is no reason to think that maintenance cost will be seriously in excess of the mechanical brake which has been displaced. The increased life of steel tires is about 85 per cent. The department owns 252 tramway and 20 railless traction cars, as well as 31 other vehicles. We note that in the building of new, and reconstruction of old track, ferro-concrete foundations have been largely used.

Bolton.—At the quarterly meeting of the Bolton branch of the Tramway and Vehicle Workers' Association, held on Sunday, it was decided to send a circular to each non-Unionist, asking him to join before November 7th, and that a general meeting be held on that date to consider what action to take with regard to the men who refused to join.

Halifax.—Year's Working.—During the year ended March 31st last, the Corporation Tramways carried, roughly, 20¾ million passengers, as against 20¼ millions the year before. The total revenue was £113,170, and the gross profit £39,666, as against £36,377 in 1913-14. After deducting financial charges, &c., the net profit for the year was £16,211, an improvement on the previous year's figure of £13,643. The parcels receipts were £2,164, as against £2,147 and 225,443 parcels were carried. The route mileage worked by the Corporation is about 38 miles, 24 being inside and 14 outside the borough. The rolling stock now comprises 101 cars, which includes 3 motor-'buses. The working costs per c.m. for the tramways were 7·57d., while the total revenue per c.m. was 11·66d. The motor-'bus accounts show working costs amounting to over 8d. per mile run, exclusive of interest and sinking fund charges, the 'buses having been purchased out of tramway profits.

The Tramways Committee has decided to ask for an extension of time for the construction of the tramways authorised by the Halifax Corporation Act, 1911.

The Committee has decided not to take any action at present with regard to fixing collapsible gates on all the cars at an estimated cost of £300.

Ipswich.—Year's Working.—The accounts of the Corporation tramway department for the year ended March 31st last show that 5,610,382 passengers were carried, as compared with 5,715,035 in the previous year, the car-mileage being considerably reduced. The total revenue was £23 288, and the gross profit £3,999, an improvement on the £3,937 of 1913-14. After meeting capital charges there was a net deficit of £2,105 on the year, as against £1,828 in the previous year. During the year the percentage of working expenses to receipts fell from 83·47 to 82 83 per cent., and the average traffic revenue per car-mile increased from 8·32d. to 8·52d. The manager, Mr. Ayton, suggests that the Council should consider the doubling of the track from the centre of the town to the Eastern termini, in the future, instead of undertaking this work on small sections.

Keighley.—Annual Report.—The borough electrical engineer's report upon the working of the Corporation tramways for the 12 months ended March 31st, shows that the revenue was £9,253, as compared with £9,380 during 1913-14. Working expenses accounted for £6,744 (£6,105), and other charges brought the expenditure during the year to £112 in excess of the amount of the revenue. The number of passengers carried showed a decrease of 54,202 at 3,552,016, though the number of car-miles run had increased from 241,917 to 247,791. Twenty-four of the department's employés had enlisted, but up to the present it had not been found necessary to employ female labour on the cars. In regard to the railless trolley system, the past 12 months had been satisfactory, the total revenue being £1,754, whilst the total mileage run was 37,775, and the number of passengers carried 225,617. During the present year the motor-omnibus undertaking had been wound up, figures relating to this concern for the year ending March 31st being:—Revenue, £1,939; working expenses, £2,678; miles run, 40,823; passengers carried, 222,881. The engineer points out the necessity of building up a substantial reserve fund—this standing at 2s. 6½d. at present—and suggests that consideration be given to the advisability of increasing the fares in the near future.

Rawtenstall.—Female Labour.—A number of women conductors commenced duty on the Crawshaw Booth section of the Corporation tramways last week-end.

TELEGRAPH and TELEPHONE NOTES.

A Telegraphic Blockade.—On Friday last the Postmaster-General announced that telegrams for all neutral countries in Europe, for Russia *via* Great Northern lines, and for Serbia, would be subject to 48 hours' delay until further notice. Telegraphic communication between Switzerland and Italy was interrupted, and private telegrams between France and neutral countries were subjected to 48 hours' delay. The notice was withdrawn on Monday.

Telegraphist's Cramp.—In the City of London Court a telegraphist named Lawbuary, living at South Norwood, was awarded £400 as compensation for incurring telegraphist's cramp while in the service of the Postmaster-General. He is also in receipt of a pension of £52 a year, and has received £153 as an additional allowance under the Superannuation Act.—*Times.*

The Telephone Service.—For trunk messages to the Isle of Wight and Ireland respectively, extra charges of 4d. and 2s. are now levied.

Wireless Telephony.—It is reported from Washington, U.S A., that the Navy Department has successfully experimented with wireless telephony from Arlington, Virginia, to Mare Island, California, a distance of 2,500 miles. Conversation was plainly heard. Successful experiments were also made in telephonic conversation over the regular wire from New York to Arlington, where the conversation was automatically transferred to the wireless apparatus and transmitted to Mare Island instantaneously.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — Sydney.— December 6th. Municipal Council. 33,000-volt outdoor transformers and switchgear. Specifications (10s. 6d.) from Electric Light Department, Town Hall.

November 4th. Deputy P.M.G. 100 miles of two-twisted and 75 miles of three-twisted, rubber-insulated, tinned copper wire. Specification No. 463, N.S.W.*

January 12th, 1916. N.S.W. Railway and Tramway Department. Two water-tube boilers, each 8,000 sq. ft. heating surface, complete with economisers, superheaters and chimney stack, for the Zara Street power house, Newcastle. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.—Specification (No. 468), 20s. each.—*Tenders.*

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

Melbourne.—December 14th. Deputy P.M.G. Eleven sections of a lamp-signalling trunk-line switchboard, and other material necessary for increasing the equipment of Melbourne trunk exchange from 108 to 240 lines. Schedule 1,207.*

Victoria.—December 14th. P.M.G. For delivery in all States, 18,670 common-battery wall pattern telephones, manufactured in Australia. Sched. No. 1,264.

Victorian Railways.—January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

Brisbane.—November 17th. P.M.G.'s Department. Switchboard parts, schedule 343; telegraph instruments, schedule No. 345.

Perth.—December 8th. 294 accumulators, and power board complete, for P.M.G.'s Dept. See "Official Notices" to-day.

Birkenhead.—October 14th. Electrical sundries, and metallic and carbon filament lamps and fittings, for the Mersey Railway Co. Mr. J. Shaw, General Manager and Secretary, Central Station.

Bootle.—October 13th. Slack coal for the Corporation electric light stations, for six months from January 1st. Forms from the Electricity Offices, Pine Grove.

Darlington.—October 22nd. Corporation. 3,000-kw. turbo-alternator; surface condensing plant. See "Official Notices" to-day.

Greystones (Co. Wicklow).—One 60-b.h.p. gas engine, alternator, switchboard panel for Greystones Electric Light and Power Co. See "Official Notices" October 1st.

Littleborough.—October 22nd. U.D.C. h.t. cables, road-work, &c., transformers and switchgear for sub-station. See "Official Notices" October 1st.

London.—October 15th. Asylum and Mental Deficiency Committee of the L.C.C. Supply of electric lamps and electrical sundries. Forms of tender from Mr. R. F. Keene, Clerk, 6, Waterloo Place, Pall Mall, S.W.

Hammersmith.—October 14th. Air-cooled transformers, for the Borough Electricity Dept. See "Official Notices" to-day.

New Zealand.—Dunedin.—November 3rd. City Council. Insulated and bare copper wire for a period of two years.* November 3rd. City Council. One 3,000-volt regulator.*

Spain.—October 17th. Municipal authorities of Fontiveros (Province of Avila). Concession for the electric lighting of the town during a period of 10 years.

Tenders have just been invited by the municipal authorities of Cullera (Province of Valencia) for the concession for the electric lighting of the town during a period of ten years.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The following contracts have been accepted:

P.M.G.'s Department, Adelaide.

Ten tons of h.d. copper wire, 200 lb. per ton, £1,155; five tons do., 100 lb. per ton. £577 10s.—R. Johnson, Clapham & Morris, Ltd.

P.M.G.'s Department, Hobart.

Five miles twisted pair o.s. distributing wire, No. 18 L W.G., £17 12s. 9d. per mile; five miles do., No. 16, £25 9s. per mile; three miles twisted pair o.s. distributing copper-clad steel wire, £16 per mile.—Western Electric Co. (Australia), Ltd.

Five miles twisted pair tinned copper v.i.r. wire, £19 1s. per mile; five miles tinned copper wire, v.i.r. insulated, £11 14s. per mile.—British General Electric Co., Ltd.

Three miles paper-insulated lead-covered cable; 12½ lb. conductors, £130 per mile.—Callenders' Cable and Construction Co., Ltd.

Three miles do. do., 26 pairs, £215 per mile.—Western Electric Co. (Aust.), Ltd.

Five tons copper wire, 100 lb per mile, £116 per ton; two tons bronze wire, 70 lb. per mile, £142 per ton; five tons, do., 40 lb. per mile, £142 per ton.—F. S. Lee.

Victoria Railways.

Electro-mechanical interlocking apparatus and spare parts at ratrs.—R. W. Cameron & Co.

N.S.W. Metropolitan Board of Water Supply and Sewerage.

Electric meters for low-level pumping stations.—Australian General Electric Co., Ltd.

West Australia Government Tender Board.

Metal-filament lamps (schedule 97A, item 1).—30 and 60 watt, 1s. 11d.; 100 watt, 2s.; 200 watt, 4s. 6d. Electric desk fans for Public Works Dept., £1,295.—C. Atkins & Co. —*Australian Mining Standard.*

Sydney City Council.

d.c. meters (Ferranti); single-phase a.c. meters (Ferranti).—Noyes Bros.
Maximum demand indicators (Reason Mfg. Co.)—W. G. Watson & Co.
5,000-volt panels for sub-station, No. 2, Lang Park.—Australian General Electric Co., £291.
Five 5,000/415-volt 100 k.v.a. transformers with switchgear, £1,014; three 10,000/415-volt 100-k.v.a. do., £716.—Australian General Electric Co.
Ten 5,000/415-volt 50-k.v.a. transformers, with switchgear, £980; four 10,000/415-volt 50-k v a. ditto, £392.—N. Guthridge, Ltd.
24 three-pole outdoor pole-type switches, £717.—Aust. General Electric Co.
Ten 5,000/415-volt 100-k.v.a. indoor-type transformers, £1,320; three 1,000/415-volt ditto, £396; eight 5,000/415-volt 200-k.v.a. ditto, £1,520; five 10,000/415-volt 200-k.v.a. ditto, £350.—N. Guthridge, Ltd.
Sub-station switchgear.—Ten 5,000-volt feeder panels without voltmeters, £1,365; four 10,000-volt ditto, £601; six 5,000-volt transformer panels, £688; four 10,000-volt ditto, £483.—N. Guthridge, Ltd.
Two 5,000-volt feeder panels without voltmeters, £255; four 5,000-volt transformer panels, £526; two 10,000-volt feeder panels without voltmeters, £311; four 10,000-volt transformer panels, £558.—Noyes Bros., Ltd.
Two 5,000-volt transformer panels, £264; two 10,000-volt ditto, £266.—Aust. General Electric Co.
Three 5,000-volt feeder panels without voltmeters, £103; six 5,000-volt transformer panels, £834; six 10,000-volt ditto, £1,191; two 10,000-volt feeder panels without voltmeters, £290.—Standard Waygood Hercules, Ltd.

Melbourne City Council.

One d.c. generator with accessories, £1,484.—Aust. General Electric Co.
Insulated cables, £2,505.—Western Electric Co.
Electric freight lift at Toorak, £595.—Edmiston & Co.

The Sydney City electrical engineer recommends that, as the whole of the tenders for a 12,000-kw. turbo-generator were informal, the deposits be returned, and that consideration of the extensions of the electrical plant be postponed. —*Tenders.*

Barrow.—On Monday the T.C. accepted the tender of Mr. J. Neal for the lining of the chimney and extension of flue at the Electricity Works, at £206; also the tenders of Messrs. G. H. Huthwaite and R. Balfour for washed small coals, at 18s. 3d. and 18s. per ton. It was decided to give formal notice to Mr. O. M. Huartson that the Corporation desired to take advantage of the provisions of the Price of Coal (Limitation) Act, 1915, and trusted that they would be able to come to terms in a friendly manner.

Burnley.—The B. of G. has accepted the tender of Messrs. F. Thornton & Co. for the supply of electrical requirements for the Workhouse.

Derby.—The Tramways Committee of the T.C. has accepted the following tenders:—

B.I & Helsby Cables, Ltd.—Copper wire, £53.
Millar's Trading Co., Ltd.—Wood blocks, £136.

The Electric Lighting Committee has accepted the tender of Messrs. Parsons & Co, Ltd., at £800, for repairs to a steam turbin

Erith.—The U.D.C. has accepted the tender of Messrs. Fraser & Chalmers, Ltd., for extensions to the electricity station, at £10,432.

Glamorgan.—Messrs. Haslam & Stretton, Ltd., of Cardiff, have again received the County Council's contracts for Britannia metal filament lamps.

Glasgow.—The T.C. City Improvements Committee has accepted the offer by Messrs. Bennet & Rutherford, at £104, for the electric wiring of the new Corporation tenements at Calton.

Halifax.—The Tramways and Electricity Committee has accepted the following tenders:—

Babcock & Wilcox, Ltd.—One water-tube boiler and superheater, £2,940.
Underfeed Stoker Co., Ltd.—Two underfeed stokers, £538.
Premier Cooler & Engineering Co., Ltd.—Two water cooling towers, £2,450.

The Guardians have accepted the tender of the Gath Electrical Co. for electrical fittings (except lamps), and that of the Rugby Lamp Co. for lamps.

Keighley.—The T.C. has accepted the following tenders:

John Smith (Keighley), Ltd.—40-ton hand travelling crane, together with a fixed gantry, £783.
Rees Roturbo Manufacturing Co., Ltd.—Electrical centrifugal pump to deliver 300,000 gallons of water per hour, at £350.

Manchester.—The Sanitary Committee has accepted the tender of Messrs. L. E. Wilson & Co. for an installation of telephones and electric bells at Baguley Sanatorium.

The Electricity Committee has accepted the following tenders:—

Sub-station switchgear (to June 30th next).—Ferranti, Ltd.
H.T. and L.T. sub-station switchboards. Ferguson, Pailin & Co., Ltd.
Two 200-K.V.A. oil-cooled sub-station transformers.—Ferranti, Ltd.
One 200-K.V.A. oil-cooled sub-station transformer.—B.W. Electric and Mfg. Co., Ltd.
Circuit breakers.—B.T.H. Co., Ltd., and Switchgear & Cowans, Ltd.
Auto-balancers and auto-transformers (to June 30th next).—British Electric Transformer Co., Ltd.
Cable.—Pirelli-General Cable Co., Ltd., and Siemens Bros. & Co., Ltd.
Paper-insulated service cables (to June 30th next).—B.I. & Helsby Cables, Ltd.
Paper-insulated cable.—L. H. Morshead & Co.
Wooden cable troughing, capping and boards (to June 30th next).—C. Jennings & Co.
Steam and gas fittings (to December 31st next).—James Russell & Sons, Ltd., and John Russell & Co., Ltd.
One 15,000-KW. turbo-alternator.—Richardsons, Westgarth & Co., Ltd., with licence to sublet the alternator to Brown, Boveri & Co., Ltd.
Water-tube boilers.—Babcock & Wilcox, Ltd., with licences to sub-let as follows:—E. Green & Sons, Ltd., economisers; The Newalls Insulation Co., lagging; and Bradley & Lonsdale, brickwork.

Salford.—The Electricity Committee has accepted the tender of Messrs. J. Wolstenholme & Son, of Radcliffe, for wrought iron piping required in connection with the additional 5,000-KW. turbo-alternator, for £70 10s.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, October 8th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

North of England Institute of Mining and Mechanical Engineers.—Saturday, October 9th. At 2 p.m. At Wood Memorial Hall, Newcastle-on-Tyne. Presidential Address by Mr. T. Y. Greener; Paper on "Modern American Coal-Mining Methods, with Some Comparisons," by Mr. S. Dean.

Association of Electrical Station Engineers.—Wednesday, October 13th. At 7.30 p.m. At Victoria Café, Shields Road, Byker, Newcastle-on-Tyne. Special Meeting for Control District and Mains Engineers only.
At 8 p.m. At 55, Market Street, Manchester. Paper on "Testing Electrical Machinery."

Association of Engineers-in-Charge.—Wednesday, October 13th. At 8 p.m. At St. Bride's Institute, E.C. Presidential Address by Mr. F. Bailey.

Institution of Mechanical Engineers.—Friday, October 15th. At 8 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Theory of Grinding, with Reference to the Selection of Speeds in Plain and Internal Work," by Mr. J. J. Guest.

NOTES.

The Electrochemical Industry in Russia.—According to the statement of the Director of the Deutsche Bank, Herr Gwinner, at the recent general meeting of the shareholders of the Bank, Germany took in the last year before the war 180,000 000 marks' worth of Chile saltpetre. As the importation of Chile saltpetre has been completely stopped by the war, the production of smokeless powder and other explosives requiring a large quantity of nitric acid produced from saltpetre has been made very difficult, and as all the stocks were requisitioned by the Government, the agriculturists of Germany were in their turn put into serious difficulties for want of chemical fertilisers. In order to solve the question of the production of fertilisers the Government decided to build two factories for the production of nitrogen from the air, one in the centre of Germany and the other in Silesia. How important this matter was considered may be judged from the fact that the work was not confided to private hands; but was retained by the Government as a monopoly. For one great factory in Germany recourse will be had to an extensive deposit of lignite as a fuel. This factory was intended originally to supply Berlin and its suburbs with electricity, and the utilisation of such deposits was one of the motives for the purchase by Berlin of the electricity works belonging to the A.E.G. Experience has shown in Germany that even from small rivers with limited fall, good results can be obtained, and as there are many such rivers in Russia, there is no reason why, with the high price of saltpetre now ruling, the production of nitric acid for explosives and of calcium nitrate for fertilisers from the air should not prove very successful in Russia. Unfortunately, however, the electro-chemical industry has hardly developed at all in Russia. In 1913 the exportation of manganese ore into Germany from Russia was valued at 17,500,000 marks. The importation into Russia of aluminium and of aluminium manufactures from Germany alone in that year amounted to 2 721,000 marks, according to the German Custom House statement, and ferro-alloys were imported to the value of 2,150,000 marks; the production of these alloys in the Caucasus, near the manganese mines, with the abundant cheap water power there, might lead Russia from being an exporter of the raw material to being an exporter of the finished products. But, for this purpose, more capital, more initiative and more technical knowledge, are indispensable.

In recent years the Germans have begun to use peat for this purpose, which is of considerable interest to Russia in view of her large reserves of this fuel. Near Hanover turf is used at the 5,000-H.P. electric station, and the original consumption of 4 kg. of peat per KW.-hour has gradually been reduced to 2 kg.

With the high prices ruling for fuel, and the shortage of foreign coal and coke, the importation of which amounted in 1913 to 527 million poods, and the value to 86,600,000 roubles, the development of the electrochemical industry in Russia can only be effected by using the natural water-power of the country, the extensive lignite deposits, and the numerous peat formations; for it is only with cheap electric power that competition can be maintained with foreign countries, the cost of production in which, for many reasons—cheaper equipment, better technical staff, and an immense scale of production, &c.—is very low.

With high protective duties alone it is impossible to build up an electrochemical industry in Russia. As the experience of foreign electrochemical factories has shown, the basis of all such production is cheap electric power, and in this direction the assistance of the Government should first of all be given.

Electricity Works Apprenticeship Scheme.—The Marylebone Electricity Supply Committee has this week reported to the Council as follows:—

"We have considered a scheme of apprenticeship submitted by the chairman, after consultation with the Council's engineers. By this scheme a limited number of apprentices could be admitted, who, after a period of probation, would be indentured. They would be given facilities for gaining a thorough training in the various branches of the department's work. After the first year's training they would gradually become very useful, and towards the end of their period of apprenticeship they would be able to fill responsible positions. This would relieve the Council of the great difficulty they now experience in retaining the services of improvers, and would minimise such troubles as were recently experienced in connection with the 'running staff.' Applications would be received only from youths over 15, who had shown special qualifications or talent for engineering work, and who had received a good technical education. During apprenticeship they would be given every possible facility for attending evening classes and technical colleges. Their remuneration would be on a progressive scale, beginning at as little as 5s. per week for the first year, and gradually rising to 20s. per week. All who showed special diligence and ability would be given every opportunity for filling vacancies on the permanent staff. We recommend that the Council approve, generally, of the adoption of a scheme of apprenticeship in connection with the electrical undertaking."

Fatalities.—A verdict of "Accidental death" was returned on Monday at an inquest on Edwin Nield (33), of Stockport, who was killed on Saturday afternoon at the works of the Lancashire Ordnance Co., Heaton Norris. A workman named Sampson Cadman stated that they were lifting an electric motor with chain blocks from a bogie on the ground floor when Nield, who was pulling the chain, suddenly swerved from side to side. The witness snatched him off the chain, and himself received a shock which rendered him semi-conscious. Another workman said that an electric cable ran alongside the joist over which the chain passed, and he found the insulation frayed at the place where it came into contact with the chain. The electric current had run down the chain and passed through Nield, who received a shock at about 286 volts.

Institution and Lecture Notes.—Faraday House.—Dr. W. H. Eccles, M.I.E.E., began a course of lectures on "Wireless Telegraphy" to the senior students of Faraday House on Tuesday, 5th inst.

Institution of Electrical Engineers.—At the time when the Institution took possession of the building on the Victoria Embankment, it was supplied with electricity at 100 volts, two-wire, from the private plant belonging to the Savoy Hotel close by, and until recently this arrangement was maintained in operation. Messrs. Handcock & Dykes, consulting engineers to the Institution, inform us that the supply has been changed over to a public source, being now derived from the mains of the Metropolitan Electric Supply Co., Ltd., at 100 volts as before, but on the three-wire system. The change-over applies both to the I.E.E. itself and to its tenants in the same building.

Society of Engineers (Inc.).—On Monday last Mr. S. G. Turner, A.M.Inst.C.E., Barrister-at-Law, read a paper entitled "Law and Engineering—Some Points of Contact." The general object of the author was to show that in almost every branch of engineering practice the provinces of the engineer and the lawyer overlap, and to advocate the establishment of some periodical meeting, open to the members of both professions, at which subjects of common interest could be discussed.

Inquiries.—Buyers of magnesite for lining electric steel furnaces are inquiring for a substitute.

Mexican Tramways.—Two Managements.—Almost immediately after the departure of ex-President Huerta from the capital, the general manager and his staff were unceremoniously relieved of their duties and their places taken by nominees of the Revolutionary Government. But even that Government had the sense not to expel these Englishmen from the city. On the contrary, I understand they were invited to remain, and they have remained to very good purpose. The position now appears to be in this wise :—There are two sets of officials, including the general manager. One—the Mexicans—draw salaries or anything they can get from the Government, and are principally occupied in watching the English staff and in smoking cigarettes. The others—the English—give all necessary instructions and exercise their best endeavours to protect the tramway and rolling stock from misuse and deterioration. They are allowed to draw their salaries from England. The arrangement, grotesque as it is, might be worse. The proprietors of the company have at least the slight satisfaction of knowing that their own officials are looking after their property so far as they are permitted. As to the net result, there appears to be only one word applicable to the situation—patience.—*The Financier.*

Appointments Vacant.—Working electrical engineer (£2 5s.) for Holmfirth U.D.C. ; works superintendent for Tramways Department, for duration of war (£150), for Southampton ; shift engineer for Pontypridd U.D.C. Electric Light and Tramways Department ; chief assistant in electrotechnics (£250) for Borough Polytechnic Institute. Particulars are given in our advertisement pages.

Volunteer Notes.—Engineering Institutions' Volunteer Training Corps.—

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week commencing October 11th, 1915 :—

Drills, 6.30 to 7.30 ; 7.30 to 8.30 p.m.

Saturday, October 9th.—Company Parade, 2.30 p.m. Route march.

Monday, October 11th.—Section 1, Technical ; Section 3, Squad signalling class.

Tuesday, October 12th.—Section 2, Technical ; Section 4, Shooting.

Thursday, October 14th.—Section 3, Technical ; Section 1, Shooting.

Friday, October 15th.—Section 4, Technical ; Section 2, Squad signalling class.

Mr. C. G. Spiers has been appointed Acting Company Sergeant-Major, vice H. N. Fullarton resigned.

In consequence of the great Recruiting March Out on Saturday, October 2nd, the Route March arranged for that day was postponed until Saturday, October 9th, at 2.30 p.m.

The work in connection with the new Headquarters at Chester House, Eccleston Place, S.W., has been commenced, and it is proposed that drills shall start there on Monday, October 18th.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, October 7th, 1915 :—

Week-end Parades.—Saturday.—The Battalion will parade at Liverpool Street Station (low-level entrance, G.E.R.) at 1.50 p.m. for Entrenching, under the Commandant. Dress : Uniform, complete with Brassard. Arms will not be carried. The Battalion will return at 6.46 p.m.

Sunday.—7 a.m., Réveillé ; 10 a.m., Church Parade ; 10.20 a.m., Battalion Parade. Inter-Company Bridging Competition. Instructions will be issued to Company Officers, later ; 2.30 p.m., Battalion Parade.

Musketry.—Saturday, 9th inst., Shooting at Acton and Bisley, as usual.

Sunday, 10th inst.—Targets have been arranged at Bisley for a limited number of Officers and N.C.O.'s. Those intending to shoot should report to Sergeant Cotter, at the Barrier of No. 9 Platform, Waterloo Station, at 10.55 a.m.

A. G. Joiner, *Major and Adjutant*, O.B.C.

London Electrical Engineers (Territorial Force).—The Corps of London Electrical Engineers was the first engineering unit formed in the British Army to make use of the services of electrical engineers. It was first started as the Electrical Engineers (Volunteers) in the year 1897 by the late Dr. John Hopkinson, and the name was changed to the present title on the formation of the Territorial Force. Numerous other units utilising the services of electrical engineers have since been formed, but the largest unit is still the London Electrical Engineers.

Owing to the expansion of the Corps, the opportunity now exists for men of suitable age and training to enlist in the unit. Men of the following professions and trades are specially required :—Electricians, mechanical and electrical engineers, engine drivers, engine erectors, instrument repairers, metal turners, fitters, telephonists and telegraphists.

There is a limited number of vacancies for carpenters, cabinet makers, pattern makers, draughtsmen, joiners and wood turners. Forms of particulars can be obtained from the Officer Commanding at 46, Regency Street, Westminster, S.W.

German Trade.—Sir William Mather, President of the Textile Institute, in opening an exhibition of textile fabrics of foreign origin at Manchester on Tuesday, declared that inquiries instituted by the Government and by various business agencies to ascertain the extent and scope of the trading operations of our enemies, had revealed a marvellous development of the trade and industry of our chief rival—Germany. During the past quarter of a century the German people had devoted themselves to the manufacture of many things of which, in former times, we had considered ourselves to have a manufacturing monopoly, and they had thrown into their work all that enterprise and organisation which had since been seen manifested in their conduct of the war. As a wise and understanding people, we ought to gain such knowledge during this period of war as would be of assistance to us in facing the rivalry of Germany, and of nations allied with Germany, in the peaceful development of commerce after the war. The first step to enable British manufacturers to reckon with them was to get to know at this present time to what extent the enemy had, before the war, permeated and penetrated the whole civilised world with their products. For that reason exhibitions such as the one he now declared open were of the greatest advantage.

Mining Engineers.—The President of the Institution of Mining Engineers has been asked by the Army Council to nominate a number of suitable mining engineers for commissions in the Tunnelling Companies of the Royal Engineers. The gentlemen appointed will receive temporary commissions, and, after short training, will get an opportunity of service at the Front. Those who have had sufficient experience of conducting underground driving operations, and would like to have their names considered, should apply at once for details of the conditions of appointment, pay, &c., to Mr. John H. Merivale, Neville Hall, Newcastle-upon-Tyne.

Catalogues Wanted.—The Eastern Electrical Co., who have recently commenced business at 111, Cleethorpe Road, Grimsby, invite manufacturers to send copies of catalogues and price lists of electrical accessories, heating and cooking appliances, &c.

Messrs. F. Paine & Son, of Connaught Avenue, Frinton-on-Sea, have taken over the Frinton branch of Messrs. Tyler & Freeman's electric lighting business. Mr. Paine has represented them for some time. Manufacturers are invited to forward lists, &c.

For Sale.—The plant, stock-in-trade, &c., of an electrical engineer will be sold by auction on October 14th, at 7, Crown Street, Bolton, by Mr. E. Haslam. Particulars are given in our advertisement pages to-day.

The Merton Case.—Sir Samuel Evans on Wednesday delivered his considered judgment in the Prize Court in the case of the Crown claim respecting 4,732 tons of zinc concentrates seized at Swansea on board the *Bilbster*. Messrs. H. R. Merton claimed the repayment of £5,000 freight. Sir Samuel condemned the cargo in question, and disallowed Messrs. Merton's claim. He said that the evidence went to show that the money was paid to the shippers on behalf of the Metallgesellschaft, and that the reason for its payment was to retain the goods for the German owners. Messrs. Merton did not hesitate to engage in commercial intercourse with the enemies of this country in their desire to get the goods for an enemy firm.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. F. E. Coupe, chief draughtsman in the Manchester electricity department, has resigned his position to take up an appointment under the Government. Mr. H. W. Sanders, who has been senior draughtsman, has been promoted to the position of chief draughtsman, at a commencing salary of £260 per annum. The Electricity Committee has decided that the vacancy caused by his promotion shall not be filled at present.

The Bridlington Electricity Committee has granted leave of absence to Mr. J. L. Ostick, junior engineer at the electricity works, for the purpose of joining His Majesty's Forces.

Mr. Whitworth, of Southend-on-Sea, has been appointed (for the period of the war) shift engineer at the electricity works of the Barnes U.D.C., vice Mr. Keiffer resigned, at a salary of £120 per annum.

Mr. A. E. Wilson has resigned his position as deputy electrical engineer at Bristol on appointment by the War Office to the position of electrical engineer to the chief engineer of the Southern Command. Mr. A. J. Newman, who has been in the service of the Electrical Committee for 11 years, has been promoted to the

position of deputy electrical engineer, at £350, rising to £400. Mr. A. J. Ostler, who has been in the employ of the Committee for 14 years, has been promoted to the office of sub-station engineer, at £200, rising to £250; and Mr. J. A. D. Pedler, who has been with the Committee for 15½ years, has been promoted to the position of mains engineer, at £175, rising to £250. Owing to the growth of the undertaking, a boiler house superintendent is to be engaged, at £200 per annum.

Wimbledon B.C. has increased the salary of Mr. W. J. Oswald, acting chief assistant electrical engineer, from £182 to £200 per annum, as from October 1st, 1915.

Tramway Officials.—Mr. Robert Simpson, engineer and manager of the Tynemouth and Whitley Tramways, Ltd., has been appointed to a similar position in connection with the Worcester Electric Tramways. Mr. Simpson has had charge of the Tynemouth Tramways for about 25 years.

Mr. J. W. Groves, tramway manager at Worcester, whose new appointment at Gravesend was notified in the last issue of the Electrical Review, has been presented by the employés of the Worcester Electric Traction Co. with an inscribed silver-plated cruet, with pickle jars, a case of pipes and tobacco, and an album containing the names of the subscribers.

General.—At Pagani's Restaurant, on Saturday evening, the staff of the American Supplies Co., Ltd.—distributors in Great Britain of "Dixie" magnetos—met to do honour to their manager, Mr. F. Farquhar, who has temporarily given up his position to take up a commission as Lieutenant in the Army Service Corps M.T.S. His colleagues presented him with a gold watch, accompanied by a testimonial on vellum. The chair was taken by Mr. H. J. Hinley, who will carry on Mr. Farquhar's duties during his absence.

Mr. A. I. Graham, A.M.Inst C.E., M.I.E.E., &c., has relinquished his appointment with Messrs. Thermit, Ltd., London, with whom he has been as engineer and assistant to managing director for the past 10 years.

In the list of aliens to whom certificates of naturalisation were granted during September the following entry appears:—Oscar Dinerman (Roumania), electrical engineer, Ferndale, Upton Heath, Cheshire. Date of oath of allegiance, August 30th, 1915.

The foremen of Messrs. Willans & Robinson, Ltd., electrical engineers, of Rugby, have presented an inscribed oak clock to Mr. Frederick Wm. Shaw, assistant works manager, on his marriage.

An Australian newspaper states that the Federal Executive Council has appointed Mr. Thomas M'Dougell Mundell electrical engineer at the Naval Dock Yard, Cockatoo Island, at a salary of £400, with a house at Cockatoo Island.

Sir T. Salter Pyne, C.S.I., M.Inst.C.E., M.Inst.M.E., whose work as chief engineer to the Government of Afghanistan is so well known, has been appointed staff captain (temporary) at the Ministry of Munitions.

We read in the *Times* that the Nottingham Corporation has resolved to confer the freedom of the city on Alderman Sir John Turney, who has been a member of the Council for 42 years. Sir John has been actively interested in the electricity undertaking and many other local enterprises.

Roll of Honour.—In connection with Manchester's effort to stimulate recruiting, a march past of 10,000 troops took place on Saturday in the city, and General Sir Henry Mackinnon, Chief of the Western Command, took the opportunity of referring to the feat of Private Walter Walker, of the 2nd East Lancashire Regiment, who, prior to his enlistment, was employed at Messrs. Glover's cable works, Trafford Park. During the fierce fighting at Neuve Chapelle a non-commissioned officer appealed for help while an advance was being made, and as soon as there came a lull, Private Walker, along with a comrade, succeeded in rescuing the N.C.O. under heavy fire. Both men have received the D.C.M., and, following General MacKinnon's statement on Saturday, the Lord Mayor of Manchester (Ald. McCabe) presented the medal to Walker. At present Private Walker is an inmate of the Crumpsall Military Hospital, Manchester, where he is receiving treatment for wounds received at La Bassee.

Private T. W. Barrett, of the 7th Lancs. Fusiliers, formerly employed at the British Westinghouse Works, Trafford Park, is in hospital in Sussex suffering from wounds received at the Dardanelles.

Private D. Crook, of the 8th Lancs. Fusiliers, who has been wounded at the Dardanelles, and is now in hospital at Exeter, was formerly employed by Messrs. Ferranti, Ltd., of Hollinwood.

Private J. C. Wooster, a member of the staff of the Richmond (Surrey) Electric Light and Power Co., Ltd., who joined the 6th Wilts. Regiment shortly after the outbreak of war, was killed in France on August 24th.

Private Henry Saxon, of the 11th Manchester Regiment, who was engaged with the Tudor Accumulator Co., Ltd., at Dukinfield, has been killed in action at the Dardanelles. He took part in the landing at Suvla Bay on August 15th, and he was later shot through the head by a sniper.

Captain Vernon W. Newman, who was attached to the Loyal North Lancashire Regiment, and who was killed in the heavy fighting in France between September 26th and 27th, was trained as an electrical engineer, and was for some time on the staff of the Central Engineering College, South Kensington. When war broke out he held a technical appointment with the Government, and obtained his commission in the 4th West Yorkshire Regiment.

We regret to record that Captain William Casson was killed in France on September 25th. He will be remembered by many of our readers as the chief assistant to the mechanical engineer of the District, London Electric and Central London Railways. He was member of both the Institution of Electrical Engineers and of the Institution of Mechanical Engineers, and was 42 years of age. He was in the London Regiment (T.F.), and according to the *Times* got his company in 1903.

Rifleman Tom West, of the King's Royal Rifles, who has been killed in action, was formerly employed at the Rochdale Corporation electricity works. He was 33 years of age.

Private A. Forsyth, 1/4th Gordons, who was killed in action, was before the war in the employment of the G.N.S. Railway electrical department.

NEW COMPANIES REGISTERED.

Ilford Dry Battery Co., Ltd. (141,694).—This company was registered on September 28th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of and dealers in dry and electrical batteries and apparatus and equipment of all kinds, electricians, engineers, metallurgists, chemists, etc. The subscribers (with one share each) are: A. S. Chetwood, 7, St. Helens Place, E.C., solicitor; G. E. Bird, 223, West End Lane, Hampstead, N.W., solicitor's clerk. Private company. The number of directors is not to be less than two or more than seven; the first are W. C. Thick and R. Harvey. Qualification, 100 shares. Remuneration as fixed by the company. Solicitors: Minet Pering, Smith & Co., 7, St. Helens Place, E.C.

H. S. M. Patent Belt Fastening Co., Ltd. (141,732).—This company was registered on October 1st, with a capital of £500 in £1 shares, to carry on the business of manufacturers of and dealers in belt fastening devices, engineers, founders, machinists, metal workers, electricians, etc., and to adopt an agreement with H. K. Mackay, C. H. Sherwood, and W. W. Hartley. The subscribers (with one share each) are: H. K. Mackay, 106, Burton Road, West Didsbury, Manchester, wine and spirit merchant; B. E. Broome, "Mayfield," St. Anne's Road, South Shore, Blackpool, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are H. K. Mackay, C. H. Sherwood, and W. W. Hartley. H. K. Mackay signs as "managing director." Qualification, £50. Remuneration as fixed by the company. Registered office: 25, Clarence Chambers, 4, Piccadilly, Manchester.

C.E.C., Ltd. (141,711).—This company was registered on September 29th, with a capital of £5,000 in £1 shares, to carry on the business of electrical, constructional, mechanical, and general engineers, founders, smiths, machinists, constructors of wharves, docks, piers, railways, tramways, railway carriages and wagons, ships, vessels, and gas, electric, drainage, sewage, and other works, etc., and to enter into an agreement with H. E. Ellis. The subscribers (with one share each) are: H. E. Ellis, 38, Fairholt Road, N., engineer; H. V. Ellis, 38, Fairholt Road, N., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are H. E. Ellis (permanent governor) and H. E. O. Ellis. Qualification, £1. Registered office: 96, Ironmonger Row, Old Street, E.C.

Cresol Chemicals, Ltd. (141,728).—This company was registered on October 1st, with a capital of £10,000 in £1 shares, to carry on the business of manufacturers of and dealers in explosives and other chemicals and munitions of war, gas makers, metallurgists, electrical and mechanical engineers, manufacturers of and dealers in electrical and scientific apparatus and materials, etc. The subscribers (with one share each) are: Auguste Oddenino, 60-62, Regent Street, W., restaurateur; Henri Terrisse, 629, Eccles New Road, Weaste, Manchester, D.Sc.; Walter Budd, 60-62, Regent Street, W., secretary. Private company. The number of directors is not to be less than three or more than five; the first are Auguste Oddenino (chairman), Henri Terrisse, and Walter Budd. Remuneration of chairman, £1,200; of W. Budd, as director and secretary, £300 per annum. Registered office: 62, Regent Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Urban Electric Supply Co., Ltd.—Subdemise to trustees for £490,000 4½ per cent. debenture stock of certain land, etc., at Illogan, dated September 16th, 1915, by way of additional or substituted security. Trustees: Merchants Trust, Ltd.

Delabole Electric Lighting and Supply Co., Ltd.—Mortgage dated September 18th, 1915, securing £200, charged on certain chattels, comprising dynamo, switchboard, pulley and driving belt, accumulators, posts, main wiring and lamps. Holders: E. Bant and Miss E. A. Bant, both of Helstone, near Camelford, Cornwall.

T. H. Brooker and Co., Ltd.—Equitable mortgage by deposit, charged on all sums due or to become due to the company under a Munitions Office contract for supply of clinometers, dated September 23rd, 1915, to secure all moneys due or to become due from the company to London and South-Western Bank, Ltd.

Ferranti, Ltd.—Mortgage and charge, dated September 10th, 1915, to secure £100,125, charged on land, buildings, etc., at Stakeleach or Stephenson Fold, Failsworth, Manchester. Holder: H.M. Secretary of State for War.

Dynamic Electrical Co., Ltd. (104,436).—Capital, £100,000 in £1 shares. Return dated December 31st, 1914 (filed June 30th, 1915). Seven shares taken up; £7 paid. Mortgages and charges: Nil.

Auto-Electric Transmission, Ltd. (124,446).—Capital, £10,000 in £1 shares. Return dated July 27th, 1915. 9,918 shares taken up; £3,806 paid; £6,112 considered as paid. Mortgages and charges: £200.

Birmingham District Power and Traction Co., Ltd. (19,077).—Capital, £1,050,000 in 35,000 cum. pref., 35,000 pref. ord., and 35,000 def. ord. shares, all of £10 each. Return dated July 5th, 1915. 20,978 cum. pref., 35,000 pref. ord., and 35,000 def. ord. shares taken up. £10 per share called up on 20,978 cum. pref., 27,000 pref. ord., and 35,000 def. ord.; £829,780 paid; £80,000 considered as paid on 8,000 pref. ord. Mortgages and charges: £411,260.

CITY NOTES.

The Swiss Brown, Boveri Co.

The report of Brown, Boveri & Co., of Baden, Switzerland, for the year ended with March 31st, 1915, states that notwithstanding, or partly in consequence of, the greatly reduced number of workmen owing to Swiss mobilisation, it was at first impossible after the outbreak of the war even fully to employ the decreased number of men, and the working time had, therefore, to be substantially diminished. The production experienced an extraordinary decline in so far as output could be spoken of at all. On the other hand, the cost of manufacturing rose beyond all comparison. It was only in the new year that the conditions to some extent approached the normal state, and in the final quarter of the financial year the arrival of orders was even satisfactory, but the production remained constantly in a very unfavourable ratio to the expenses, and it scarcely exceeded at present one half of the normal output. That the financial results were not very much behind those of the preceding year was due to the large amount brought forward from 1913-14, to the circumstance that the extraordinary provision made for depreciation could be omitted on this occasion, and to the fact that one-third of the year fell in the period of peace, and the dividends of the subsidiary companies, and other important items of revenue arising from trading with them, were always accustomed to be brought into account in the following year. As a consequence of the very careful valuation of the investments, the company was able to restrict the amount set aside for war risks to £20,000, notwithstanding the fall in values owing to the war. Nevertheless, it was not out of the question that in the future course of events losses might still occur which could not be foreseen now. The investments amounted to £1,127,000, as compared with £1,099,000 in 1913-14, the increase being due to the payment of fresh instalments on existing obligations, and £736,000 of the first-mentioned total represented interests in manufacturing undertakings. The accounts show the following figures for the two years:—

	1913-14.	1914-15.
Share capital	£1,280,000	£1,280,000
Loan capital	880,000	880,000
Gross profits	475,000	388,000
General expenses	191,000	171,000
Depreciation	104,000	67,000
Net profits and balance forward ...	123,000	94,000
Placed to war risks' fund	40,000	20,000
Dividend percentage	5	5
Carried forward	17,000	4,800

The report mentions, further, that the branches of manufacture remained entirely unchanged during the past year. In particular, the company took up no new branches of any kind during the war and in connection with it. The company strictly refrained from any manufacture of war material in so far as the question was not to concern orders for the Swiss confederation. It is added that it was impossible at present to give any expression as to the future prospects, as everything depended upon the deliveries of raw materials, and to a further degree on the duration of the warlike complications.

Chilian Electric Tramway and Light Co., Ltd.

The result of operations for the year ended December 31st, 1914, after deducting interest and redemption of debentures, London office and other charges, shows a balance to the credit of profit and loss account of £106,086, plus £9,438 brought forward, making a total net balance to credit of £115,524. From this £60,000 has been placed to renewals reserve account, and £7,000 to insurance suspense account. There remains a balance of £48,524, which it is proposed to carry forward to next year, as having regard to war conditions, the directors do not recommend the payment of any dividend. During the year the tramways carried 108,282,117 passengers, earning 9,704,088 dol., as against 109,444,597 passengers, earning 9,765,669 dol. in 1913, but again owing to the increase in the working expenditure, and the fall in the exchange, the result is a decrease in the profit of 308,400 dol. The progress of the lighting department continues; the receipts during 1914 amounting to 8,614,258 dol., as against 7,658,983 dol. in 1913. Various items of construction have been proceeded with during the year, and the capital expenditure has been increased by the sum of £156,824.

The Board regret the death of Mr. S. W. Jameson, who held the appointment of secretary of the company since its formation, and was only elected a director in February of last year. His loss at a most critical time is deeply felt. Mr. W. B. Rommel has been elected to fill the vacancy.

Mr. C. Middleton Kemp, of Messrs. Kemp, Sendell & Co., has been appointed under the Trading with the Enemy Act, 1914, supervisor of the company's business by the Board of Trade.

Mr. Carl Edler, who was appointed to fill the office of local auditor, was unable to attend to his duties owing to the war, and Mr. R. Neveling was nominated local auditor in his place by the management in Santiago with the approval of the Board.

The annual meeting was held in London on September 29th.

Amalgamated Wireless (Australia), Ltd. — The report for the six months ended June 30th showed a profit of £1,672, which, with £4,328 brought forward, made £6,001 available. A dividend of 3½ per cent. absorbs £4,900, making the dividend for the year 6 per cent., and £1,101 is carried forward. Trading (says the *Sydney Morning Herald*) has been seriously interfered with by the war, and profits have suffered. The ships' message traffic, though still subject to disabilities, has improved, and the subsidy ships operated by the company have been increased by five in the six months, and now number 85. The company is now manufacturing the greater part of its requirements. Positions are kept vacant without loss of seniority for all permanent employés on active service, and over 80 trained men have already been supplied by the company to the defence authorities in Australia, New Zealand, and the United Kingdom.

Direct United States Cable Co., Ltd. — Interim dividend 2s. per share, less income-tax at 3s. 2d. in the £, making a total distribution of 4 per cent. for the half-year ended September 30th.

Calcutta Electric Supply Corporation, Ltd.—The directors have declared an interim dividend on the ordinary share capital at the rate of 7 per cent. per annum for the six months ended June 30th, 1915, payable November 15th.

Sao Paulo Tram, Light and Power Co., Ltd.— The directors have declared a dividend of 2½ per cent. on the issued common stock, payable on November 1st.

Babcock & Wilcox, Ltd.— Interim dividend, 6 per cent. on the ordinary shares, free of income-tax.

STOCKS AND SHARES.

Tuesday Evening.

Bulgaria is the baffling factor in Stock Exchange markets just at the moment, but the possibility of her taking active sides with the Central European Powers—which possibility may be translated into something more definite before our day of publication—has had little material effect upon quotations. In point of fact, the War Loan retains the strong tone which set in towards the end of last week; and as the War Loan for the time being is the index to all the markets in the Stock Exchange, it may be said that the Bulgarian attitude has had surprisingly little influence in the markets. Hopes are high and strong that the advance of 10 days ago in Flanders will be steadily continued; and although there must necessarily be spaces of time between one "thrust" and the next, all the news which is allowed to come through is taken to indicate such pressure upon the part of the Allies that the enemy lines will be thrown back with a run when the next order for a general progressive movement is given.

Meanwhile, the casualty lists contain many well-known City names; and the Stock Exchange, like most other large bodies, has to mourn the loss of sons whose names now stand enrolled upon the highest Lists of Honour.

The telegraph market is the firmest amongst the electrical sections. No doubt the fact that dividends are paid free of tax on several of the best class shares has much to do with the demand for these. Some weeks ago, it was not easy to sell stock; to-day, it is just as difficult to buy it. Deceased accounts which were overhanging the market have been absorbed with ease just lately. Other holders are not eager to sell.

Directors of these undertakings now stand abundantly justified in the conservative policy which they have pursued for many years past, in the way of buttressing their companies' reserves and entrenching them in a position of great financial strength. Criticisms have been levelled at the boards for what was called their conservatism—sometimes a harder word was used—in refusing to pay more substantial dividends; and if they had yielded to the demands made upon them for distributing the greater part of the profits, it is as likely as not that the dividends could not have been maintained in days like these. Thanks to the strength of the financial positions, however, the companies are able to continue their usual distributions, and proprietors have every reason to be grateful to their directors for the manner in which they have withstood the temptation to divide more closely to the hilt the earnings in many years past.

The Eastern group is one of the firmest; and Globe Ordinary, with Western Telegraphs, are amongst those which the public want to buy. Anglo-American Telegraphs are also wanted, owing principally to the prosperity that has fallen upon the United States in consequence of the war. The striking success of the Anglo-French Loan has had the effect of bringing into request the stocks and shares of most of the companies doing an inter-ocean trade. This success is the more gratifying in view of the failure of the attempts made by Germany to raise money in the United States, American bankers refusing to look at German proposals unless they were accompanied by guarantees of collateral security, and undertakings that borrowed money should be spent in the States. But with Great Britain holding the seas, it was

impossible for Germany to make sure of getting her goods from the States, even if she spent the money there, and so the negotiations came to an abrupt and an untimely end.

A recovery of 5 points has lifted Indo-European shares to 45, wiping out half the loss of last week; so that the people who bought the shares at 34½ have now an excellent profit. New York Telephone bonds have risen to 99½, at which the return to the British investor is obviously too small, compared with that on the War Loan. It is with this last that the intending buyer should carefully match his prospective purchases, always bearing in mind the probability that, upon the issue of the next War Loan, the interest on the existing 4½ per cent. Loan will in all likelihood be raised automatically to the same as that provided by the new comer. Anticipation looks for a 5 per cent. Loan somewhere about Christmas-time, and also for the present 4½ per cents. to become straight away a similar-interest security. New York Telephone 4½ per cents., taking these as our text, pay £4 10s. 6d. per cent. on the money; whereas the War Loan yields £4 14s., and this will probably be raised to 5 per cent., which will have the effect of emphasising the disparity.

British Westinghouse Preference have risen another shilling, and the 4 per cent. Debenture stock is once more 2 points higher, these rises being due to sympathy with the boomlet in Westinghouse shares which are dealt in by New York. American Marconis recovered to 19s. 9d. on Tuesday morning, reacting a few pence later on in the day, which still left them 1s. 6d. higher than they were towards the end of last week. Canadian Marconis are a little firmer at 6s. 3d., and the parent shares braced up to 1 1/16.

Movements in the prices of Home Electricity shares are few, but they trend mostly in the downward direction. The latest Police Order, regulating London's lighting, and the Nubian blackness which nightly envelops so many of the London suburban streets, are not "bull" points for electric lighting shares. In some few cases the prices of these are standing sufficiently, if not too, high when tested by the principle of the War Loan referred to above; these, doubtless, will be adjusted gradually. According to Stock Exchange authorities, the leading companies are now able to operate at a steadily lowered ratio of expenditure, thanks to the introduction of labour-saving machinery; but the increased cost of coal and the decreased consumption of current are bound to tell upon dividends in the near future.

Metropolitan Railway Consolidated stock regained its recent small loss, but Districts are dull at 13. Underground Electric Ordinary £10 shares shed half-a-crown, although the Company's income bonds at 71½ are the fraction to the good. The bonds are in request on behalf of investors to whom the payment of dividend free of tax offers a decided attraction.

In the foreign list, Brazilian Tractions have risen to 50, the Rio Exchange recovering to 12 11/32d. The Preference shares have also hardened; in view of the satisfactory earnings of the Company, they begin to look an attractive speculative investment at the present price of 86½, at which the return is nearly 7 per cent. on the money. Shawinigan Water shares are also firm, as are most of the companies connected with Canadian industries. The immense orders being placed for war material in Canada and the United States are forcing a good deal of money into these stocks. In the Mexican group there is nothing fresh to mention. Argentine Tramways issues have again declined, and the Company's Second Preference shares are now back to 3. Consolidated Gas, Electric Light and Power of Baltimore shares have had substantial rises to 111 for the Common shares, and 115 for the Preferred. The British Columbia group is attracting no attention.

Armament shares remain steady, and rubber shares are well held, in consequence of improvement in the price of the raw material to 2s. 5½d. per lb. Mr. McKenna has abandoned his intention of taxing imported motor tires, and this is regarded as something of a bull factor, although there is still a good deal of discussion going on as to whether the rubber companies will be required to hand over 50 per cent. of their extra earnings this year by way of Excess Profits tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Blackpool-Fleetw'd	Sept. 25	7,035	+2,122	38	33,886	— 458	8	..
Bristol	„ 24	40,359	+5,135	38	966,093	+22,729	30·5	..
Chatham and Dist.	..	..	..	..	..	..	..	..
Cork	„ 25	2,248	+ 270	38	19,285	— 58	54·25	..
Dublin	„ 24	25,930	+2,599	38	234,898	+ 8,849	9·89	..
Hastings	„ 23	5,551	+ 989	..	..	— 2	19·3	..
Lancashire United	„ 29	8,029	+1,468	42	68,787	+ 3,963	42	..
Llandudno-Col. Bay	„ 24	2,210	+ 532	43	15,189	+ 1,272	6·5	..
Tyneside	„ 22	2,573	— 462	12	8,033	— 73	11	..
Anglo-Argentine ..	„ 30	197,353	-5,788	39	1,980,825	—187,719	..	..
Auckland	Aug. 27	19,876	—1,170	8.2	42,029	— 2,828	25·42	1·06
Calcutta	Sept. 27	17,493	— 864	..	..	— 6,982	..	..
Kalgoorlie, W.A. ..	July	2,776	..	31	18,954	..	..	..
Madras	Sept. 15	2,05[illegible]	+ 239	37	33,319	+ 458	..	..
Montevideo ..	Sept.	25,070	— 156	39	303,417	—31,548	..	..
Dublin-Lucan Rly.	Sept. 24	706	+ 114	12	2,096	+ 33	7	..

SHARE LIST OF ELECTRICAL COMPANIES.

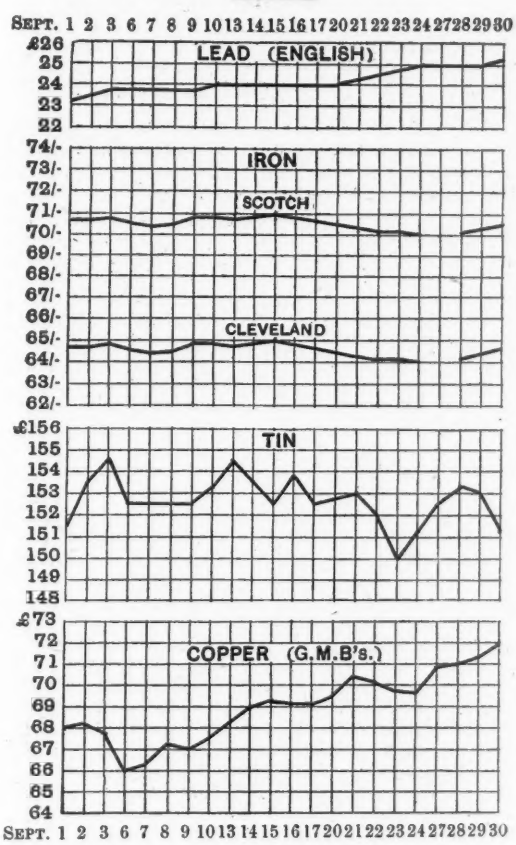
	Dividend, 1914.	Price Oct. 4, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7½	— ¼	£6 18 4
do. 7 per cent. Pref.	7	7	— ¼	5 0 0
Charing Cross Ordinary	5	3⅜	—	6 13 4
do. do. do. 4½ Pref.	4½	3⅞	—	6 0 0
do. do. City Pref.	4½	3⅝	— ¼	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4¼	—	5 17 8
do. 4½ Deb.	4½	87	—1	5 3 6
City of London	9	12½	—	7 7 0
do. do. 6 per cent. Pref.	6	10⅜	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10⅛	—	6 16 7
do. do. 6 per cent. Pref.	6	10⅜	— ¼	5 17 3
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	86	—	5 6 0
Kensington Ordinary	9	6¼	—	7 4 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4¼	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	3½	2¼	—	7 15 7
do. 4½ per cent. Pref.	4½	3⅜	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6⅜	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6⅜	—	6 18 4
do. 4½ Pref.	4½	4¼	—	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	99½	+1	6 0 7
do. Def.	1½	22	—	6 16 4
Chile Telephone	3	6¾	—	6 3 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12	—	*6 13 4
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord.	7	118	+2	*6 15 7
do. 8½ Pref.	8½	66	—	5 6 0
do. 4 Deb.	4	80	—	5 0 0
Globe Tel. and T. Ord.	6	9⅜	—	*7 0 8
do. Pref.	6	9⅜	—	6 3 0
Gt. Northern Tel.	22	33	—	6 13 4
Indo-European	13	45	+5	7 4 5
Marconi	10	1 1/16	+ 1/16	5 3 1
New York Tel. 4½	4½	99½	+ ½	4 10 6
Oriental Telephone Ord.	10	1 1/16	— 1/16	5 3 1
do. Pref.	6	1	— ⅛	6 0 0
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5⅝	+ ⅛	*8 2 6
do. Pref.	6	4¼	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12	—	*6 13 4
do. 4 Deb.	4	80	—	5 0 0
Home Rails.				
Central London, Ord. Assented	4	70	—	5 14 4
Metropolitan	1½	23½	+ ½	6 6 8
do. District	Nil	13	— ½	Nil
Underground Electric Ordinary	Nil	1⅜	— ⅛	Nil
do. do. "A"	Nil	5/6	—	Nil
do. do. Income	6	71½	+½	*9 11 8
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	8⅞	— ¼	7 17 2
do. 2nd Pref.	5½	8	— ¼	9 3 4
do. 4 Deb.	4	73	—	5 9 7
do. 4½ Deb.	4½	72	—	6 5 0
do. 5 Deb.	5	74	—	6 15 2
Bra Tractions	8½	50	+ ½	7 0 0
Bombay Electric Pref.	6	10½	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	40	—	Nil
do. 6 per cent. Bonds	—	85	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	—	—
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	98	—	5 2 0
Manufacturing Companies.				
Babcock & Wilcox	14	2 3/16	—	6 8 5
British Aluminium Ord.	5	1 1/16	—	4 14 1
do. Pref.	6	18/8	—	6 9 9
British Insulated Ord.	15	10⅝	—	7 1 2
do. Pref.	6	5½	—	5 2 2
British Westinghouse Pref.	7½	34/-	+1/-	8 10 8
do. 4 Deb.	4	72	+2	5 11 1
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref.	5	4½	—	5 11 3
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	61/-	—	4 18 6
Edison & Swan, £8 pd.	Nil	10/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	58	—	6 18 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	18/-	—	9 4 8
do. do. Pref.	7	19/)	+9d.	7 1 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	12½	—	*9 2 0
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8	—	6 5 0
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Tucuman Tramways, Light and Power Co., Ltd.—A financial daily states that the accounts for the period from March 26th, 1914, to June 30th, 1915, after providing for interest on debenture stock, show a debit balance at profit and loss account of £42,517. The meeting of the company was held in London yesterday.

METAL MARKET.

Fluctuations in September.



Glasgow market closed September 27th.

Standards in Trade Journalism.—We note that the recent Convention of the Federation of Trade Press Associations of America adopted a set of "Standards of Practice for Business Papers," a few of which we quote:—

"The publisher of a business paper should dedicate his best efforts to the cause of business and social service, and to this end should pledge himself:—

1. To consider, first, the interests of the subscriber.
2. To subscribe to and work for truth and honesty in all departments.
3. To eliminate, in so far as possible, his personal opinions from his news columns, but to be a leader of thought in his editorial columns, and to make his criticisms constructive.
4. To refuse to publish "puffs," free reading notices or paid "write-ups;" to keep his reading columns independent of advertising considerations, and to measure all news by this standard: "Is it real news?"
5. To decline any advertisement which has a tendency to mislead or which does not conform to business integrity.
6. To solicit subscriptions and advertising solely upon the merits of the publication."

We are not sufficiently acquainted with the factors in the American situation, which have rendered necessary the adoption of such a standard of conduct in the sphere of trade journalism. There are a few journals on this side, one of which is well known to our readers (its natural modesty forbids us to name it!), which have endeavoured to act up to this high standard for many years past. We are glad to find our American contemporaries adopting a lofty ideal, and wish them every success in their organised efforts to attain to it.

Newcastle-on-Tyne.—Volunteer Motormen.—The shortage of employés on the Corporation system has created a serious difficulty, especially with regard to the early morning cars. To assist in relieving the situation, 75 volunteers, including 40 members of the Volunteer Training Corps, have offered their services as motormen and conductors. This has been of immense assistance, and has proved so satisfactory, that 11 other members of the V.T.C. are in training. Several members of the clerical staff of the tramways department have given assistance, and a dozen ex-motormen and conductors who had spare time in the morning, have been engaged.

AMERICAN EXPORTS OF ELECTRICAL GOODS.

The following figures, showing the exports of electrical goods from the United States during the year ended June, 1914, are taken from the recently-issued trade statistics; where possible figures for 1912-13 have been added for purposes of comparison, and notes of any increases or decreases given:—

	1912-13. Dollars.	1913-14. Dollars.	Inc. or dec. Dollars.
Telegraph instruments.—			
To Canada	37,000	16,000	− 21,000
,, Central America	6,000	14,000	+ 8,000
,, Mexico	15,000	9,000	− 6,000
,, Colombia	33,000	6,000	− 27,000
,, Argentina	—	1,000	+ 1,000
,, Cuba	66,000	1,000	− 65,000
,, Brazil	18,000	29,000	+ 11,000
,, Other countries	40,000	61,000	+ 21,000
Total	215,000	137,000	− 78,000
Telephone instruments.—			
To United Kingdom	151,000	55,000	− 96,000
,, Canada	779,000	432,000	− 347,000
,, Central America	7,000	38,000	+ 31,000
,, Mexico	42,000	23,000	− 19,000
,, Cuba	79,000	82,000	+ 3,000
,, Brazil	107,000	336,000	+ 229,000
,, other S. America	37,000	140,000	+ 103,000
,, Japan	30,000	14,000	− 16,000
,, Australia	5,000	277,000	+ 272,000
,, Other countries	135,000	156,000	+ 21,000
Total	1,372,000	1,553,000	+ 181,000
*Other electrical instruments and appliances.**—			
To Canada	5,968,000	3,760,000	− 2,208,000
,, Mexico	1,153,000	326,000	− 827,000
,, Panama	1,012,000	566,000	− 446,000
,, Cuba	610,000	374,000	− 236,000
,, Argentina	362,000	358,000	− 4,000
,, Brazil	2,375,000	947,000	− 1,428,000
,, Japan	1,067,000	483,000	− 584,000
,, Philippine Islands	344,000	244,000	− 100,000
,, Australia	672,000	516,000	− 156,000
,, United Kingdom	781,000	574,000	− 207,000
,, Other countries	3,103,000	2,292,000	− 811,000
Total	17,447,000	10,440,000	− 7,007,000

* Included *Insulated wire and cables* in 1912-13.

Gas engines, stationary.—			
To Canada	150,000	144,000	− 6,000
,, Argentina	23,000	26,000	+ 3,000
,, Australia	28,000	13,000	− 15,000
,, Europe	104,000	111,000	+ 7,000
,, Other countries	107,000	89,000	− 18,000
Total	412,000	383,000	− 29,000
Electric motors.—			
To United Kingdom	150,000	461,000	+ 311,000
,, Canada	1,033,000	833,000	− 200,000
,, Panama	233,000	221,000	− 12,000
,, Mexico	441,000	264,000	− 177,000
,, Cuba	148,000	131,000	− 17,000
,, Argentina	82,000	109,000	+ 27,000
,, Brazil	272,000	179,000	− 93,000
,, Chile	104,000	93,000	− 11,000
,, British India	105,000	99,000	− 6,000
,, Japan	399,000	829,000	+ 430,000
,, Australia	264,000	268,000	+ 4,000
,, Other countries	567,000	1,055,000	+ 488,000
Total	3,798,000	4,542,000	+ 744,000
Petrol engines, stationary.—			
To Canada	1,269,000	1,009,000	− 260,000
,, Argentina	334,000	200,000	− 134,000
,, Australia	341,000	290,000	− 51,000
,, Mexico	40,000	34,000	− 6,000
,, United Kingdom	100,000	89,000	− 11,000
,, Other countries	793,000	709,000	− 84,000
Total	2,877,000	2,331,000	− 546,000
Steam engines, stationary.—			
To Canada	260,000	190,000	+ 70,000
,, Cuba	100,000	38,000	− 62,000
,, Mexico	51,000	40,000	− 11,000
,, Brazil	78,000	4,000	− 74,000
,, Philippine Islands	20,000	29,000	+ 9,000
,, Other countries	199,000	437,000	+ 238,000
Total	708,000	738,000	+ 30,000

	1912-13. Dollars.	1913-14. Dollars.	Inc. or dec. Dollars.
Electric locomotives.—			
To Canada	146,000	28,000	− 118,000
,, Panama	25,000	354,000	+ 329,000
,, Cuba	43,000	—	− 43,000
,, Haiti	21,000	—	− 21,000
,, Chile	17,000	4,000	− 13,000
,, China	—	34,000	+ 34,000
,, Other countries	22,000	17,000	− 5,000
Total	274,000	437,000	+ 163,000
Dynamos and generators.—			
To Canada	585,000	397,000	− 188,000
,, United Kingdom ...	342,000	333,000	− 9,000
,, Panama	121,000	43,000	− 78,000
,, Mexico	166,000	26,000	− 140,000
,, Cuba	122,000	235,000	+ 113,000
,, Brazil	114,000	136,000	+ 22,000
,, Peru	109,000	12,000	+ 97,000
,, Japan	848,000	869,000	+ 21,000
,, Australia	117,000	92,000	− 25,000
,, Spain	24,000	182,000	+ 158,000
,, Other countries	225,000	309,000	+ 84,000
Total	2,773,000	2,634,000	− 139,000
Fans.—			
To Canada	133,000	70,000	− 63,000
,, Argentina	53,000	87,000	+ 34,000
,, Brazil	20,000	26,000	+ 6,000
,, China	25,000	27,000	+ 2,000
,, British India	37,000	47,000	+ 10,000
,, Japan	10,000	25,000	+ 15,000
,, Australia	6,000	10,000	+ 4,000
,, Uruguay	6,000	17,000	+ 11,000
,, Other countries	69,000	124,000	+ 55,000
Total	359,000	433,000	+ 74,000
Arc lamps.—			
To Canada	91,000	35,000	− 56,000
,, Brazil	52,000	14,000	− 38,000
,, Other countries	43,000	28,000	− 15,000
Total	186,000	77,000	− 109,000
Carbon filament lamps.—			
To Canada	13,000	7,000	− 6,000
,, Mexico	113,000	98,000	− 15,000
,, Brazil	28,000	10,000	− 18,000
,, Other countries	74,000	57,000	− 17,000
Total	228,000	172,000	− 56,000
Metal filament lamps.—			
To Canada	56,000	26,000	− 30,000
,, Mexico	55,000	31,000	− 24,000
,, Cuba	38,000	18,000	− 20,000
,, Argentina	42,000	13,000	− 29,000
,, Brazil	53,000	25,000	− 28,000
,, Australia	34,000	13,000	− 21,000
,, Other countries	117,000	93,000	− 24,000
Total	395,000	219,000	− 176,000

	1912-13.	1913-14.
Insulated wire and cables.—		
To United Kingdom ...		133,000
,, Spain	Included	112,000
,, Canada	in	267,000
,, Panama	*Other*	273,000
,, Mexico	*electrical*	100,000
,, Cuba	*instruments*	215,000
,, Brazil	*and*	323,000
,, Australia	*appliances.*	121,000
,, Other countries		448,000
Total		1,992,000
	1912-13.	1913-14.
Static transformers.—		
To United Kingdom ...		35,000
,, Spain		422,000
,, Canada		106,000
,, Panama		137,000
,, Mexico	Not	99,000
,, Cuba	shown	55,000
,, Brazil	separately.	148,000
,, Chile		38,000
,, Japan		23,000
,, Australia		47,000
,, Other countries		345,000
Total		1,455,000

THE PROBLEM OF THE "POINT-FIVE" TARIFF.

[COMMUNICATED.]

(*Concluded from page* 444.)

Figs. 3 and 4 show that neither on a basis of rateable value nor of units sold per annum, do the mean prices per unit charged to various groups of consumers in the above-mentioned statistics, show continuity or equity. In fig. 3 the points relating to each undertaking are linked together, but except in the cases of Blackpool and Sunderland the resulting curves are wildly erratic. Though not varying consistently, the Blackpool mean prices per unit consumed

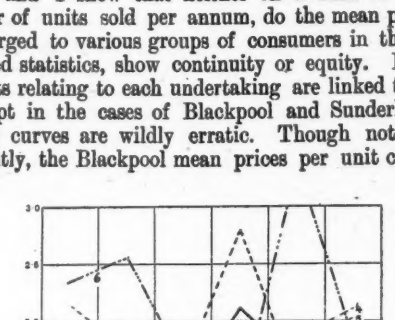


Fig. 3.—Mean Price per Unit for Houses of Different Rateable Values.

lie within a relatively small range. The definite upward character of the Sunderland curve (No. 5) is due to the increasing percentage charge on R.V. in that town as the actual rateable value increases. In all the other instances consumers living in houses of a certain R.V. may pay more or less for their energy than the average per unit paid by dwellers in smaller or larger houses.

Plotting the average price paid per unit against the average units consumption per annum (fig. 4) we obtain points which cannot be linked to form a curve for each town. Taken *en masse* the prices show a tendency to

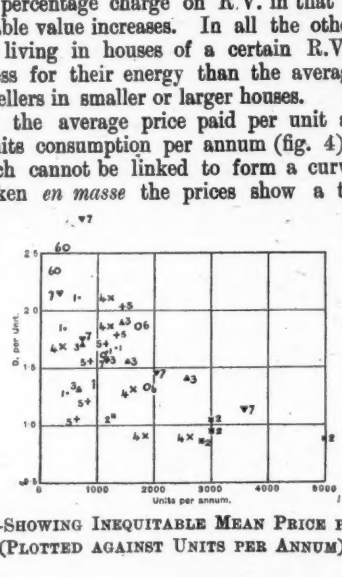


Fig. 4.—Showing Inequitable Mean Price per Unit (Plotted against Units per Annum).

decrease with increasing annual consumption (at first rapidly then more slowly) but for each particular town the points are very erratic. Once again the Sunderland points show the most "character," and for the same reason as before, but whereas the Sunderland prices *rise* considerably with the average annual consumption of the several groups, the Blackpool prices *decrease* moderately, and the Wrexham prices very considerably, and with fair consistency. Where such contradictory results exist it is not safe to carry deductions too far, but the main purpose of figs. 3 and 4 is already served by emphasising the extraordinary fluctuations in mean price with both rateable value and annual consumption. The points plotted representing averages for groups of consumers, the results for individual consumers are probably far more erratic.

Perhaps the most disturbing feature of fig. 4 is the considerable distance between points of the same series on the same ordinate, *i.e.*, the considerable difference in average

price per unit paid by consumers taking the same amount of energy but using it in houses of different rateable value.

Nor can this discrepancy be justified by attributing it to differences in load factor, for sometimes the difference is in one direction and sometimes in the other. It may be contended that these wide fluctuations are only temporary, and would be smoothed out if every householder developed to the full his "electricity consuming capacity." Undoubtedly that is so, to a considerable extent. The rateable value tariff, like any tariff based on a minimum fixed charge, encourages free consumption, since the average price per unit then decreases rapidly, though the total amount of the bill increases.

For example, a consumer subjected to 12½ per cent. fixed charge on £50 rateable value and charged ½d. a unit, for all consumption, would have his total liability fixed on the following scale :—

Consumption per annum.	Energy charge.	Total charge.	Mean price per unit.
500 units ...	250d.	1,750d.	3·5d.
1,000 „ ...	500d.	2,000d.	2·0d.
1,500 „ ...	750d.	2,250d.	1·5d.
2.500 „ ...	1,250d.	2,750d.	1·1d.
5,000 „ ...	2,500d.	4,000d.	0·8d.

This table shows several things. It helps to explain the extraordinary fluctuations visible in the preceding curves, for though consumption of extra units increases the total bill but slowly, it reduces the mean price per unit rapidly. If a consumer chooses to consume more energy without exceeding a certain maximum demand, there is every reason why he should receive his whole supply at an appreciably lower average price, but there is no justification for charging Messrs. A, B, and C at the average rate of 1·1d., 1·5d., and 1·9d. per unit respectively for equal annual consumption of 1,500 units in each case, just because they live in houses assessed at £30, £50 and £70 respectively.

If the maximum demand in the several cases were related definitely to the rateable value, the latter would be a reasonable basis, but it is only too well known to the average citizen that the rateable value of his house bears no relation to the number of his household or the domestic utility of the building. District, size of garden, and assessor's whim are a few of the factors determining the rateable value. Number and position of windows, nature of surroundings, number and habits of household are factors influencing the consumption of electricity for lighting and other domestic purposes. Where is the connecting link between these groups of factors? Admittedly, in a general way, higher rateable value means a larger house and larger maximum demand, but is there, in the first place, any definite relation between the two, and ought, in the second place, a consumer to be penalised just because, for one reason or another, he does not develop his electrical consumption in the manner, and to the extent which his rateable value indicates as possible? Surely the answer to both questions is in the negative.

On the average for a whole district the rateable value tariff may be equitable, and in most cases where it is working it *is* equitable as between supply authorities and consumers as a body, but is this altogether unconnected with the facts that the tariff has only been in vogue a few years, and when it was put into force it was deliberately arranged to give what might be called "average equity?" In other words, is not the tariff very largely artificial—with just that basis of reason sufficient to make it plausible and workable for the nonce?

The rateable value tariff must already be responsible for grave anomalies between the current consumption and bills of individual consumers, and such anomalies cannot be good for the development of the industry as a whole. In many cases the consumer has alternative tariffs which he can adopt if he feels himself aggrieved, but the alternatives are usually—if not invariably—such as to place either them or electric heating and cooking out of the question. The "point-five" tariff is essential to healthy heating and cooking development, and some form of supplementary fixed charge is necessary if all units are to be sold at the same rate and through the same wiring. The maximum demand system in a modified form is, in the writer's opinion, the best and fairest possible. Every consumer is entitled to special consideration of his case, since, after all, it is to meet the electrical engineers' difficulties and limitations that any departure at all from the flat rate is required.

The ordinary exposition of the Wright system: "So much a unit for the first hour's use per diem of maximum demand and so much a unit afterwards," is muddling to the layman. Of course it is, and it is safe to say that a good percentage of canvassers who rattle out the phrase so glibly are unable to explain it. It is not necessary to raise the householder's suspicions by this formula, nor is it necessary to install maximum demand indicators. It is, at this date, quite easy to estimate what will be the average maximum demand for any proposed equipment, and so to determine a fixed charge which shall be fairer to the consumer than the R.V. charge can be, whilst being, for the district as a whole, equally satisfactory to the station.

Naturally, some consumers will take higher power at times than that to which they are strictly entitled, but, in the aggregate, this will not constitute a serious problem, and, over a year's working, all consumers will have benefited to much the same extent by this concession without the station having experienced any particular inconvenience. No doubt, basing the fixed charge on kilowatts installed, will check installation to some extent, but this consideration cannot be held to justify imposition of an unfairly high fixed charge on a section of the consumers, as is necessarily the case where the rateable value basis is adopted. The latter has the effect of checking any installation at all! The R.V. basis amounts to saying to the consumer: "living in a house like this, with a garden like this, and in a district like this, you ought to consume so much current. If you don't, you will have to pay dearly for what we do supply; and, anyhow, your bill can't be less than so much, and will be so much more before the average price is really cheap." Expressing in words what the tariff does in fact, renders it sufficiently clear that whatever the "business getting" merits of the R.V. tariff, due to its being so simply expressed and understood, it cannot be regarded as a system likely to produce continuous and permanent development and satisfaction.

In the Marylebone district of London the initial charge under the "point-five" tariff is based on £18 13s. 4d. per calculated maximum demand of lighting, this calculated maximum being 70 per cent. of the watts installed (less purely "convenience" lights). The average annual consumption of

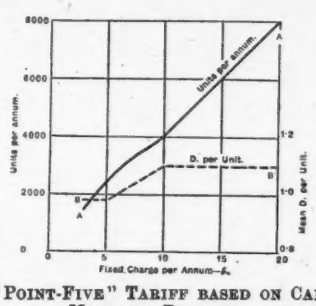


Fig. 5.—"Point-Five" Tariff based on Calculated Maximum Demand.

consumers, subject to annual charges, ranging from £3 to £20, is then as shown in fig. 5, curve A, the mean price per unit ascending gradually and fairly smoothly as shown by curve B. Without dilating further upon this particular tariff, it is mentioned in illustration of the rationality of making the fixed charge depend directly on maximum demand.

Whether the maximum demand be that for all purposes or that for lighting alone, or whether discrimination be made between the maximum demand for lighting and that for heating and cooking (each being charged at a separate rate) is a matter for the supply engineer to decide in each particular case. To achieve a satisfactory solution in the particular case is much easier than in the general or purely abstract case, where tariffs are concerned. The difficulty of explaining maximum demand systems to consumers has been much exaggerated; the whole problem can be much simplified, while maintaining sufficient practical accuracy, by substituting estimated maximum demand (as a definite percentage of installation) for actual maximum demand as measured by demand indicators.

Though much has already been written concerning the rateable-value tariff, the writer believes this further contribution to be justified by the apparent tendency to consider an R.V. percentage the standard initial charge under a "point-five" tariff. This tendency could hardly fail to be inimical to the best development of electrical heating and cooking, and the present temporary check in these fields, and in the introduction of cheapened tariffs, affords an excellent opportunity to discuss whether recent developments have really been along sound lines. No consideration of avoiding risk and worry at the time of introducing a fresh tariff ought to be taken as justifying one which will not prove permanently satisfactory.

LEGAL.

An Interesting Wages Claim.

Judge Mellor, at the Manchester County Court on Thursday of last week, had before him a case in which an employer sued a workman, whom he had engaged, but who subsequently wrote that he could not fulfil the engagement, for one week's wages, and for a further week's wages in lieu of notice. The defendant agreed to enter plaintiff's service in August, but a fortnight before he should have started he sent plaintiff a postcard to the effect that he could not fulfil the engagement. Plaintiff thereupon tried to get another workman to take the place of defendant, but he was unsuccessful. Defendant now pleaded that the engagement was not definitely concluded, and declared his belief that he was not liable, since he never entered on the work and gave notice that he did not intend to do so a fortnight earlier.

His Honour found that there had been a breach of contract as the engagement had been made and not kept, but held that plaintiff was entitled to one week's wages only, and gave judgment to that effect, with costs.

Dublin Electricians Fined.

The Dublin Munitions Court has imposed a fine of £1 each on nine electricians for leaving work. It was complained against the men that they took part in a strike without having first had the matter of difference referred to the Board of Trade. Messrs. Edmundson's Electrical Corporation, the employers, are contractors for Government work, and defendants were employed under them at a certain factory. The Court overruled an objection which had been raised that Mr. Bruty, Messrs. Edmundsons' manager, the complainant in the summonses, was not the aggrieved party, and announced that if a settlement were made, and the men returned to work, the fines would not be enforced.

WAR ITEMS.

The War and Station Engineers.—Like kindred organisations, the Association of Electrical Station Engineers has been adversely affected by the war. Approximately 250 members have joined His Majesty's Forces, and many members have left station work to take up more remunerative work in other sections of the engineering industry, the majority going into the factories for munitions work. A large number of station engineers have taken advantage of this opportunity for transferring their services to other departments of activity, where the opportunities for advancement and the remuneration are better than in station work. These men have been a great loss to the A.E.S.E., as they have been, we are informed, men of energy and spirit; the same may be said of those who have joined H.M. Forces, though it is anticipated that they will resume their active membership when hostilities cease. Owing to the loss of men from the stations, chief engineers are, it is said, putting difficulties in the way of further men leaving, and in some cases there have been certain instances of injustice which the A.E.S.E. is at present actively investigating. At the end of May last a meeting was held of the A.E.S.E. London Committee and representatives of the Associated Municipal Electrical Engineers (Greater London), when the A.E.S.E. again put forward the suggestion for the forming of a combined committee to which all differences which occurred in stations in the London district could be referred, and the matter is still under consideration by the A.M.E.E. The set-back which the A.E.S.E. had to contend with in the early months of the war has been practically overcome, and new members are joining at a satisfactory rate. The greatest progress has been made in the Newcastle-on-Tyne Branch, which has lately become very active and has been successful in obtaining some concessions with regard to cancelled holidays, etc., for the members. Negotiations are still proceeding with regard to increased salaries. Since January of this year a monthly circular, entitled "Progress," has been sent to all members of the Association, in which discussions on subjects of interest are published. This circular was started chiefly for the benefit of members who are scattered in different parts of the country and are a long distance from the important centres, and, in consequence, cannot attend meetings. The A.E.S.E. is continually making efforts to better conditions in individual stations and has generally effected some improvement in each case.

The War Spirit in Australia.—Mr. P. J. Pringle, chief engineer and general manager of the Electric Supply Company of Victoria, Ltd., Ballarat, who, as most electric supply men will remember, left these islands some years ago to take up his present position in Australia, has sent us a large poster card which has been designed by a prominent Melbourne engineer, who is circulating it at his own expense. The object of this poster, which we reproduce below, is obvious. As our readers will have gathered from our frequent references to the anti-enemy attitude in Australia, feeling runs extremely high out there in regard to trading with the enemy, both now and after the war. The very prospect of ever again finding it necessary to deal with German firms or their representatives and handling German-made goods is as the effective administering of an emetic in its consequences. Therefore, it is not surprising that this very plain-speaking poster is being freely adopted in Australia by business firms. Mr. Pringle expresses the hope that the

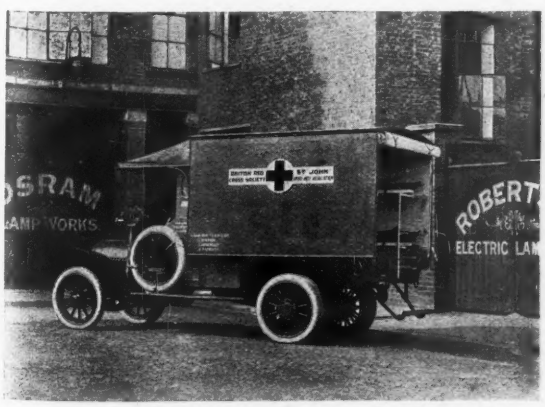
REMEMBER
Louvain
Rheims
Ypres
Rape
Murder
Loot
Poisonous
Gases
Burning
Petrol
Poisoned
Wells
Starving
Prisoners
"Falaba"
"Lusitania"
Etc.
Etc.
NO ORDERS
EXCEPT
"GET OUT"
FOR
GERMANS
German Agents
OR
Representatives
OF
German Firms
OR
Goods.
A NATIONAL POLICY FOR AUSTRALIANS.
Germans in this country should have no vote in Commonwealth, State, or Municipal elections.
No German, whether naturalised or otherwise, should be eligible during the continuance of the war for election to either Federal or State Parliaments, to any municipal body, or to any Water Trust.
No men of German birth should be permitted to hold commissions as Magistrates, or as Justices of the Peace.
No German firm should be permitted, now or hereafter, to trade here under a title that conceals its nationality.
Heavy duties should be imposed on all Enemy goods, and should be made irremovable by statute for a period of 10 years after the conclusion of the war.

sentiments that it sets forth will be approved of by the Home firms, and judging from what we hear them say, and the correspondence that reaches us, he is not far wrong in regard to many of them. The last clause of the policy, as printed on the right-hand side of the poster, is not strong enough for Mr. Pringle. In his opinion nothing short of a "national appeal" should ever again allow enemy goods to enter Australia, and that he is not by any means alone in this idea may be gathered from the following resolution which he moved at, and secured the adoption of by, a recently held meeting of employers:—"That in the interests of the Empire this Association supports and approves of prohibitive restrictions being placed by the Federal Government on the importations of enemy goods into Australia, and urges that such restrictions remain in force until a national appeal calls for reconsideration of the matter." Mr. Pringle voices Australian feeling thus:—"The indecision of the Home Government much surprises us out here."

Foreign Electrical Firms and the Manufacture of Munitions.—It has become an exceedingly bitter pill for the Germans to swallow that certain electrical and other firms in the United States have manufactured munitions of war for the British Allies—a fact which has been discussed in this country and is well known throughout the world. But an instance has arisen in Europe which has been eagerly seized upon by a Frankfort newspaper (the leading commercial and industrial organ in Germany) as a glorious example of "industrial neutrality," as it is termed. The case in question is that of the Swiss firm of Brown, Boveri & Co., from whose annual report for 1914-15 a sen-

tence has been extracted which, it is said, will be read with equal attention in Germany and the United States, although with very different sentiments. The sentence runs:—"The branches of manufacture remained entirely unchanged during the past year. In particular, the company took up no new branches of any kind during the war and in connection with it. The company strictly refrained from any manufacture of war material in so far as the question was not to concern orders for the Swiss confederation." Such a statement, the Frankfort newspaper declares, is all the more noteworthy because the matter affects an undertaking of the heavy electrical industry which is specially suitable for being transformed into one for the production of war material. The newspaper proceeds to remark that the possibility was open to earn large war profits—it was open to all—for the Swiss company would not at all have needed to favour one party of belligerents at the cost of the other, as war material could have been delivered to all (!) yet the company "strictly refrained from any manufacture of war material." This point of view is held by the German newspaper to be "highly un-American," as is sought to be shown by the quotation of a second case, where a certain neutral country's orders, offered in the United States, are stated to be only acceptable provided that the country in question is on the side of Great Britain and her Allies. Yet it was reported about two months ago that German contracts for munitions were being executed in the United States and the deliveries forwarded to South America for re-exportation to the Fatherland via Holland and Denmark. We are, however, not particularly concerned with this side of the problem. What is, however, of great importance is the fact that comparatively small nations which are co-terminous with Germany have the fate of Belgium before their eyes, and they have been frequently warned to be circumspect in their attitude towards Germany. Under the circumstances these small nations, or their engineering firms, for obvious reasons would not undertake to manufacture munitions for the use of the central powers, whilst their proximity to the latter would act as a deterrent to any production of war material for the British Allies, even if the engineering firms in the comparatively little countries were willing to contract for work of this kind. It is far from our intention to suggest that the Swiss company in question would work for either one combination of nations or the other. No doubt all Swiss firms, having regard to the enormous consumption of small arms and gun ammunition in the present war, together with the part played by heavy guns, are strained to the utmost of their capacity in meeting the requirements of their own Government in munitions so as to provide against any possibilities of the future, and in so far as labour, which is extremely scarce owing to the mobilisation, is available. Apart, however, from this point of view, it has to be remembered that the Baden company possesses extensive interests in Germany, including the subsidiary company of the same name at Mannheim, and material interests may be expected to carry a considerable weight in the present times. It is scarcely necessary to state that the German newspaper does not inform its readers whether the Mannheim company is or is not producing war material; nor does it say that it would be possible for long-range guns on German territory to reach Baden, provided that no mountain chain offering an adequate obstacle intervened between the two districts. As a consequence the German contention that the Swiss company could have delivered war material to all the belligerents falls to the ground. It would have been possible to forward supplies to Germany or Austria, but for the reasons stated any such deliveries to the other group of nations would have been out of the question.

Osram-Robertson Red Cross Van.—The illustration herewith shows the ambulance van presented to the St. John's Ambulance Association by the Osram-Robertson Lamp Works, Ltd. This van is designed to carry eight patients,



the driver and an attendant, and the design of every detail of the equipment conforms to the latest and best practice. The van was photographed outside the Osram-Robertson Lamp Works at Hammersmith, but it is now doing valuable service.

The German War Loan.—The "Ironmonger" states that the following were subscribers to the third war loan to the amounts stated:—

Siemens & Siemens Schuckert Companies	... £650,000
The War Metal Co.	... 250,000
Auer Incandescent Gas Light Co., Berlin	... 125,000
Duisburg Cable Works	... 100,000
Hackethal Cable & Wire Works, Hanover	... 50,000
Engineering Works, Ehrhardt & Sehmer, Saarbrücken	... 20,500

Electricity Works Employés.—Three workmen employed at the Eccles Corporation's electricity works resigned recently, and the Electricity Committee has directed the Town Clerk to communicate with the Minister of Munitions with a view to preventing its workpeople going to other employment except by consent of the Corporation.

Controlled Establishments.—The Minister of Munitions has declared 264 additional factories as controlled establishments, bringing up the total to 979 on October 4th.

OUR LEGAL QUERY COLUMN.

"Interested" writes:—"A local authority having power to wire consumers' premises, sell and hire electrical apparatus, etc., appoint a selling agent. The agent, who lives within the borough boundary, purchases a number of second-hand motors, at an agreed price, from the Corporation in question for the purpose of re-selling. Is it essential for the authority to whom these powers have been granted to satisfy themselves that their agent only re-sells to persons residing inside the borough, and for use on their supply?"

*** Without knowing the exact terms of the Provisional Order under which the lighting authority in question sell and hire apparatus, it is difficult to say whether the proceeding referred to in the query is legal or not. If they were authorised "to sell" generally, without qualification, it does not appear that their right to do so can be limited to consumers or other persons within the area of supply. If they have power to sell at all, it would not seem to be illegal for them to supply motors, second-hand or new, to an agent within the district wholly irrespective of the use to which he proposed to put them afterwards.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

RUSSIA.—As a result of negotiations between the British Ambassador in Petrograd and the Imperial Russian Government, it has been decided that Russian Consular Officers in the United Kingdom and in British oversea territories will, as from August 1st, issue visa and legalise free of charge certificates of origin covering goods of British origin exported to Russia.

The Russian Government have decided that the prohibition of the exportation of steel and lead by all land and sea frontiers of European Russia applies also to manufactures and alloys of these metals.

BRITISH HONDURAS.—Under a new tariff which has recently been put into force a duty of 15 per cent. *ad valorem* is levied on all goods not separately mentioned in the tariff; this rate will apply to a considerable number of electrical and similar goods.

SIBERIA.—It has been decided that importation of the following goods into Siberia *via* Yenesei River may be allowed free of duty:—Cast-iron in pigs, scrap and filings; manufactured iron (bar iron, etc., ingots, pigs, iron rails, sheet and plate iron, shaped iron, etc.); tinplate and sheet iron painted, varnished, galvanised, or coated with common metals; steel (in bars, billets, scrap, sheets, shaped steel, etc.); tin (in pigs, rods, scrap, sheets, even polished and amalgam); boilermakers' wares of iron or steel, and pipes and connected parts of iron or steel; wire of iron or steel; machines and apparatus complete or incomplete, fitted together or in parts, of cast-iron, wrought-iron or steel, with or without parts composed of other materials, even if combined with copper to an extent not exceeding 25 per cent. of the total weight of the machine; also spare parts of such machines and apparatus composed of the same materials imported together with the machines and apparatus.

NORWAY.—The Norwegian Customs Department have decided with reference to their prohibited exports that alloys of metal are not prohibited to be exported unless they are specially mentioned in the list of prohibited exports, as, for example, "antimony and alloys" and "copper and alloys of copper with common metals." This decision, however, only applies to cases in which the constitution of the alloys is normal. In cases where a metallic alloy contains an unusual

amount of a metal of which the exportation is prohibited, the prohibition is to be applied to such alloy also. In doubtful cases, the exporter will be required to prove that the constitution of the alloy is normal.

AUSTRALIA.—The Board of Trade has received from the High Commissioner for Australia a statement as to the method of paying duty under the new Australian Customs Tariff on advertising matter sent to Australia through the post. This matter, which is taken to include catalogues, prospectuses, billheads, labels, etc., etc., is dutiable if of United Kingdom production at the rate of 8d. per lb., or 35 per cent. *ad valorem*; or, if produced elsewhere, at the rate of 10d. per lb., or 40 per cent. *ad valorem*. In each case the rate applicable is that which produces the higher duty, but it will be found that, with very rare exceptions, the duty may be properly assessed at the specific rate (8d. or 10d. per lb.) on such matter imported through the post.

2. The rates mentioned apply to all the advertising matter and other articles referred to above, whether introduced through the post or otherwise, and even when forwarded in single copies per post addressed to individuals, except in cases coming under paragraph 5.

3. In the case of advertising matter sent through the post to individuals the duty may be paid by any of the methods specified hereunder:—

(*a*) The total weight of any one mail may be ascertained by a consignor, and the duty payable as mentioned in paragraph 1 may be remitted in one sum to the Deputy Postmaster-General of the State to which the advertising matter is addressed. In such cases a notification that such remittance has been made should appear on each packet.

(*b*) The duty may be paid on the same basis as in (*a*) by the consignor's agents in the Commonwealth.

(*c*) Duty stamps may be affixed to each package covering the amount of duty payable on same. These stamps may be purchased in denominations of ½d., 1d., 2d., 3d., 4d., 5d., 6d., 7d., 8d., 9d., 10d., 11d., and 1s., from the offices of the Commonwealth of Australia in London, 72, Victoria Street, London, S.W. The Duty Stamps must be cancelled by the sender before dispatch by writing or stamping the date across the face.

(*d*) If none of the above methods be followed, postal surcharges will be made in the Commonwealth to cover the duty due on each packet.

4. For the purpose of paragraph 3 (*c*) and (*d*) the following scale of charges on fractions of a pound weight has been approved:—

Amount.	If of United Kingdom production.	Otherwise.
½d.	Up to 1 oz.	Up to ¾ oz.
1d.	,, 2 ,,	,, 1½ ,,
1½d.	,, 3 ,,	,, 2¼ ,,
2d.	,, 4 ,,	,, 3¼ ,,
2½d.	,, 5 ,,	,, 4 ,,
3d.	,, 6 ,,	,, 4¾ ,,
3½d.	,, 7 ,,	,, 5½ ,,
4d.	,, 8 ,,	,, 6¼ ,,
4½d.	,, 9 ,,	,, 7¼ ,,
5d.	,, 10 ,,	,, 8 ,,
5½d.	,, 11 ,,	,, 8¾ ,,
6d.	,, 12 ,,	,, 9½ ,,
6½d.	,, 13 ,,	,, 10½ ,,
7d.	,, 14 ,,	,, 11¼ ,,
7½d.	,, 15 ,,	,, 12 ,,
8d.	,, 16 ,,	,, 12¾ ,,
8½d.		,, 13½ ,,
9d.		,, 14½ ,,
9½d.		,, 15¼ ,,
10d.		,, 16 ,,

5. In cases where the total duty on any one mail addressed by any one consignor to any one State of the Commonwealth does not exceed 1s., the payment of duty is waived. If there is reasonable ground for belief that this concession is being abused by the distribution of a consignment over more than one mail, the whole of the matter affected is to be charged duty. When this exemption is claimed for any consignment each package should bear an intimation that the total duty does not exceed 1s.

6. As the Imperial postage regulations do not allow any postal packet to contain any enclosure addressed to a different person at a different address, the use of Commonwealth Duty Stamps issued from the High Commissioner's Office is limited to packets sent to single addresses, and such duty stamps must not be used in connection with the dispatch of circulars, etc., packed together but intended for different addresses.

China Covers for Switches.—In view of the necessity for economising in the use of metals, Messrs. J. H. Tucker & Co., of King's Road, Hay Mills, Birmingham, have drawn our attention to a line of china-covered flat type switches which they are supplying in a variety of colours, to harmonise with surrounding woodwork. The "light oak" and "mahogany" coloured switches which they have sent us as samples, are admirable imitations of these woods; dark oak and walnut can also be matched, and covers of this kind possess decided advantages over the usual white and black china covers, of which also the firm supplies large quantities.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

13,344. "Connections of electrical conduits." F. W. Uren. September 20th.

13,357. "Electric switches." F. C. Stockel. September 20th.

13,388. "Electric switches." H. Lucas & W. C. Turner. September 20th.

13,389. "Laminated armatures for magneto-machines, cores for electric coils, and the like." H. Lucas & W. H. Edwards. September 20th.

13,415. "Manufacture of electrical conductor or wire retaining bands and apparatus therefor." E. Fewkes. September 21st.

13,436. "Electric ignition of internal-combustion engines." J. W. T. Cadett & C. Percy. September 21st.

13,438. "Production of X-rays." Sir J. M. Davidson. September 21st.

13,450. "Thermic telephones and like instruments." Pieter de Lange and Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. September 21st.

13,458. "Keys of electrical telegraph transmitters." H. E. Allcock. September 21st.

13,469. "Driving and controlling dynamo-electric generators." W. F. Wilkinson & J. Firth. September 22nd.

13,481. "Dynamo-electric machines." F. A. Heys (Neuland Patents, Ltd., U.S.A.). September 22nd. (Complete.)

13,482. "Dynamo-electric machines." F. A. Heys (Neuland Patents, Ltd., U.S.A.). September 22nd. (Complete.)

13,483. "Dynamo-electric machines." F. A. Heys (Neuland Patents, Ltd., U.S.A.). September 22nd. (Complete.)

13,484. "Dynamo-electric machines." F. A. Heys (Neuland Patents, Ltd., U.S.A.). September 22nd. (Complete.)

13,498. "Electric lamps." F. Mead. September 22nd.

13,504. "Electrical distribution systems." E. T. Williams. September 22nd.

13,555. "Incandescent electric lamps." W. J. Hermges. September 23rd. (Complete.)

13,561. "Dynamo-electric machines of the commutator type." G. Schroeder. September 23rd

13,562. "Dynamo-electric machines of the commutator type." G. Schroeder. September 23rd.

13,568. "Means for minimising sparking at break of a circuit containing inductance and capacity in series." T. F. Wall. September 24th.

13,600. "Locking lamp socket." T. H. A. Brown. September 24th. (Complete.)

13,614. "Electric selective devices." A. H. Morse & Indo-European Telegraph Co., Ltd. September 24th.

13,615. "Supply of electric energy to wireless telegraphy installations." A. H. Morse & Indo-European Telegraph Co., Ltd. September 24th.

13,618. "Insulating airtight joints for terminals of vapour electric apparatus." British Westinghouse Electric & Manufacturing Co., Ltd. (Westinghouse Electric & Manufacturing Co., United States). September 24th (Complete.)

13,655. "Automatic circuit-interrupting devices." A. du Pasquier & J. M. L. Slater. September 25th.

13,679. "Electro-magnetically-operated mechanisms." R. S. Lewis. September 25th.

PUBLISHED SPECIFICATIONS.

1914.

19,809. Process for Producing the Lining of an Electric Induction Furnace. G. Brüstlein. September 15th.

20,908. Arrangements for Synchronising Apparatus having similar Periodic Movements. W. P. Thompson (Soc. Anon des Telegraphes Edouard Belin). October 13th.

22,226. Mercury Switches. G. Wilkinson. November 9th.

24,368. Fuses or Cut-outs for Electric Circuits. V. Hope. December 21st. (Addition to 22,575/13.)

1915.

498. Selecting Devices operated by Current Impulses. O. Imray (Siemens and Halske Akt. Ges.). January 12th.

553. Electric Locks and Switches for Lifts. Smith, Major & Stevens, Ltd., and C. G. Major. January 13th.

863. Sparking Plugs for Internal-combustion Engines and the like. W. F. Grafton and W. G. Cairney. January 19th.

982. Electrical Apparatus for Effecting the Chemical Combination of Gases. C. C. Meigs. January 21st. (January 23rd, 1914.)

1,113. Electric Switch for use with Weighing Scales. W. & T. Avery, Ltd., and R. R. Gibbs. January 23rd.

2,236. Electric Pedal Switches. Robert Bosch (firm of). February 11th. (July 29th, 1914.)

2,248. Electric Welding. E. I. Heinsohn. February 11th. (February 21st, 1914.)

3,283. Electric Controllers. Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). March 1st.

3,565. Arrangements for Operating Switching Devices by Electric Current Impulses. O. Imray (Siemens & Halske Akt. Ges.). March 5th.

3,997. Electrically-driven Radial-arm Drilling and the like Machines. H. Wilkinson. March 13th.

4,097. Production of Rontgen Rays. J. E. Lilienfeld. March 15th. (November 15th, 1913.)

6,196. Combination Electric Switch and Fuse. A. H. Short. April 26th. (Addition to 8,453/14.)

Strike at Schenectady.—A Central News dispatch says that 10,000 men employed in the workshops of the General Electric Co. at Schenectady, New York, struck work on Monday.